SONOMA STATE UNIVERSITY

Mathematics and Statistics Department 2024 Program Review Self Study

Program Context and Curriculum

Overview of the Department

The Sonoma State University Department of Mathematics and Statistics (hereafter, “the Department”) provides a robust and dynamic curriculum designed to meet the diverse needs of students pursuing degrees in mathematics, statistics, and related fields. The Department offers Bachelor of Arts (B.A.) degrees in Applied Statistics, Mathematics, Statistics, and Bi-disciplinary mathematics, and Bachelor of Science (B.S.) degrees in Mathematics and Statistics, as well as minors in Mathematics, Mathematics for Teachers, Statistics, and Applied Statistics. In addition to serving majors, the Department plays a crucial role in General Education (GE) at Sonoma State, offering a variety of quantitative reasoning courses, including foundational coursework in calculus, statistics, and mathematical reasoning, to students from across disciplines.

The curriculum is designed to prepare students for graduate studies, teaching careers, and employment in many quantitative fields, reflecting national and regional workforce needs. The Mathematics B.A. provides flexibility through its Pure Mathematics and Secondary Teaching concentrations, while the Mathematics B.S. focuses on Applied Mathematics. The B.A. in Bi-disciplinary Mathematics is designed to work well as half of a double major, enabling many students to bring a high degree of mathematical sophistication to their chosen fields. Similarly, the B.A. in Applied Statistics and B.S. in Statistics emphasize statistical analysis and data science applications, equipping students with analytical skills relevant to a data-driven world; the B.A. in Applied Statistics, like the Bi-disciplinary Mathematics major, works well as half of a double major.

Mission of the Mathematics and Statistics Department

We invite and welcome students from all educational and cultural backgrounds to join us in creating an active, collaborative learning community that celebrates the complexity, beauty, and applicability of mathematics and statistics. (Adopted April, 2018)

Program Learning Outcomes

The Program Learning Outcomes (PLOs) for the Department of Mathematics and Statistics at Sonoma State University include four that are common to all of our programs, and four each that are specific to either the mathematics or statistics programs. The common PLOs emphasize critical thinking, problem-solving, communication, and collaboration. These outcomes reflect the core competencies expected from students across all concentrations within these fields.

Common to All Programs

C1. **Critical Thinking & Ethical Conduct**
Students will understand different types of reasoning used to make conclusions in the discipline, including identifying coherent arguments and weaknesses. They will demonstrate responsible and ethical conduct in their interactions with colleagues and in selecting, formulating, and analyzing questions.

C2. **Problem Solving**
Students will be able to assess and interpret complex situations, choose among several potentially appropriate mathematical or statistical methods of solution, persist in the face of difficulty, and present solutions that include appropriate justification for their reasoning.

C3. **Communication in the Discipline**
Students will be able to effectively communicate mathematical and statistical concepts to diverse audiences, adapting their presentation style as needed.

C4. **Collaboration in Diverse Teams**
Students will be able to work collaboratively in diverse teams, leveraging different perspectives to solve complex problems.

Mathematics Programs

The Mathematics programs include the B.A. in Mathematics (pure and secondary teaching concentrations), the B.S. in Mathematics (Applied Mathematics Concentration), and the B.A. in Bi-disciplinary Mathematics. These programs address the common learning outcomes above, as well as the following discipline-specific goals. Each program addresses all four of these learning outcomes, with more focused emphasis as indicated in parentheses.

M1. **Mathematical Justification** (Pure, Secondary Teaching)
Students will be able to read, understand, and construct clear mathematical arguments, including formal proofs, to support their conclusions.

M2. **Breadth of Mathematics & Mathematical Connections** (Bi-disciplinary, Secondary Teaching)
Students will understand the broad range of mathematical areas and be able to identify and articulate connections between different mathematical concepts.

M3. **Mathematical Depth** (Pure, Applied)
Students will develop a deep grounding in at least one area of mathematics or its application, demonstrating expertise and comprehensive understanding in that field.

M4. **Mathematics as a Tool in Other Disciplines** (Applied, Bi-disciplinary)

Students will understand how mathematics is applied as a tool to solve problems in various other disciplines and be able to use mathematical methods in interdisciplinary contexts.

Statistics Programs

The Statistics programs include the B.A. in Applied Statistics and the B.S. in Statistics. Both programs share the common learning outcomes above and have the following additional statistics-specific learning outcomes. Outcome four below is emphasized much more in the B.S. than in the B.A.

S1. **Statistics and Data Science as an Iterative Process**
Students will understand statistics and data science as an iterative process of extracting insights from data to inform decision-making across various disciplines.

S2. **Generating Questions in Statistics**
Students will be able to formulate statistical questions and critically interrogate data to drive meaningful analysis.

S3. **Data Analysis and Statistical Software**
Students will be able to select appropriate statistical techniques to answer questions of interest, obtain relevant data, and carry out statistical analyses to inform decision-making. They will also demonstrate proficiency in standard statistical software packages and effective data management strategies.

S4. **Mathematical and Probabilistic Foundations**
Students will understand the mathematical and probabilistic principles underlying statistical methods, enabling them to apply these foundations to complex statistical problems.

Each program's curriculum is designed to ensure alignment between coursework and PLOs. Courses are sequenced to introduce, reinforce, and assess key learning objectives at appropriate levels, ensuring that students develop foundational skills in lower-division coursework and engage in deeper, discipline-specific inquiry in upper-division courses. The PLOs map nicely onto the Western Association of Schools and Colleges' (SSU's accrediting body) Core Competencies—written and oral communication, quantitative reasoning, critical thinking, and information literacy—with particular strength in quantitative reasoning and critical thinking.

General Education and Service to Other Programs

Beyond supporting mathematics and statistics majors, the Department plays a vital role in General Education (GE) as well as critical support for all STEM fields and for other quantitative fields such as social sciences and business. Courses such as Elementary Statistics (Math 165),

Modern Geometry (Math 150), and Calculus I (Math 161) fulfill Quantitative Reasoning (B4) GE requirements, providing essential analytical skills to students across all disciplines.

General Education Learning Outcomes (Quantitative Reasoning)

These goals are specified by the University for students completing their Quantitative Reasoning General Education requirements.

GE1. **(Quantitative Reasoning)**:
Interpret, evaluate, and employ quantitative analysis and arguments.

GE2. **(Disciplinary and Interdisciplinary Knowledge)**:
Identify, interpret, and apply methods, intellectual approaches, and fundamental concepts from disciplines within the social sciences, natural and physical sciences, arts, and humanities.

GE3. **(Communication)**:
Communicate clearly and eloquently in written, oral, and/or performative forms in a variety of genres and disciplines.

Since the last program review, the Department of Mathematics and Statistics has made significant adjustments to its GE program in service of these learning outcomes, especially emphasizing quantitative reasoning, critical thinking, and engagement with social issues. This commitment is evident through coordinated efforts in curriculum design, instructor collaboration, and innovative pedagogical approaches tailored to foster student engagement and success. The Department offers GE courses designed to serve all majors at SSU.

The Stretch Program for First-Year Students is a notable innovation that supports students who may need additional time and support to develop their mathematical proficiency. These year-long, cohort-model courses allow students to work on appropriate college-level material with whatever mathematical background they bring.

The Stretch Program has positively impacted student success rates, reducing the rates of students receiving D, F, or W grades (DFW rates) compared to previous developmental courses (see the Assessment section of this study). This reduction in DFW rates reflects the program's success in supporting student retention and progression, particularly for those from traditionally underserved groups. When paired with other efforts such as the TIPS program discussed below, the Department of Mathematics and Statistics demonstrates a robust commitment to inclusive, high-quality GE education that aligns with SSU’s learning outcomes and prepares students for academic and real-world challenges in a supportive, equitable environment.

Alignment with Strategic Goals and Core Values

The Department's curriculum, learning outcomes, and culture align with Sonoma State University's strategic priorities (Student Success, Academic Excellence and Innovation, Leadership Cultivation, and Transformative Impact) and core values (Diversity and Social Justice, Sustainability and Environmental Inquiry, Connectivity and Community Engagement, and Adaptability and Responsiveness) in many ways. Most evident throughout this self study are our commitment to Student Success, Diversity and Social Justice, and Academic Excellence and Innovation. As part of an Hispanic-Serving Institution (HSI), the Department actively promotes inclusive pedagogical practices that support the success of students from historically marginalized backgrounds. Initiatives such as the Louis Stokes Alliance for Minority Participation and the Transformative Inclusion in Postsecondary STEM : Towards Justice program reinforce these commitments by building a more inclusive mathematical and scientific community.

Pedagogical Methods and High-Impact Practices

The Department prioritizes active learning, student engagement, and culturally responsive instruction in all courses. The Mathematical Association of America (MAA) Instructional Practices Guide serves as a framework for many of the Department's pedagogical approaches, including collaborative learning, inquiry-based learning, and real-world problem-solving activities.

In recent years, faculty have engaged in Lesson Study, a research-based instructional improvement process that involves collaborative planning, teaching observations, and analysis of student learning. The TIPS program has also introduced *rehumanizing mathematics* approaches, which emphasize student agency, belonging, and the cultural relevance of mathematics.

Active Learning

The Mathematics and Statistics Department is committed to implementing pedagogical practices that promote deep student engagement, conceptual understanding, and the development of problem-solving skills. In alignment with the Department's active learning statement (see the Appendix), we emphasize instructional methods that prioritize student participation, foster collaborative learning environments, and encourage the active construction of knowledge. These methods are designed to not only help students master mathematical and statistical content but also develop critical thinking and communication skills that are essential for success in both academic and professional settings.

The Department's approach is strongly informed by the Mathematical Association of America (MAA) *Instructional Practices Guide*, particularly the section on Classroom Practices. The guide underscores the importance of creating a student-centered learning environment where students are not passive recipients of information, but active participants in the learning process. This principle is central to our pedagogical framework. Faculty are encouraged to

utilize active learning techniques such as group problem-solving, student presentations, peer instruction, and interactive technology to create dynamic classroom experiences. By incorporating these techniques, students are given opportunities to engage deeply with the material, ask questions, and collaborate with peers, all of which research has shown to improve both understanding and retention of mathematical concepts.

To further enhance student engagement, the Department incorporates various formative assessment strategies to provide timely feedback and adjust instruction in response to students' needs. Regular use of think-pair-share activities, problem-based learning, discussion-based approaches, and opportunities for revision and reflection allows instructors to gauge student comprehension in real-time and tailor instruction to address misconceptions or difficulties. The MAA guide highlights that such practices support an inclusive classroom environment by offering multiple pathways for students to engage with the material, participate in discussions, and demonstrate their understanding.

Transformative Inclusion in Postsecondary STEM

The **Transformative Inclusion in Postsecondary STEM: Towards Justice (TIPS)** program represents a significant innovation in STEM education at Sonoma State University, particularly within the Mathematics and Statistics Department. TIPS seeks to transform departmental culture and classroom practices in ways that promote inclusion, particularly for underrepresented groups in STEM, including Latin*[1] students, Native American students, African-American students, and women. The TIPS program, funded by the National Science Foundation (NSF), aligns with national efforts to broaden participation in STEM and is a key element of the Department's strategic approach to pedagogy.

Key Components of the TIPS Pathway

A. **Workshops and Professional Development on Equity Issues:** The TIPS Pathway begins with a four-day workshop aimed at educating faculty on factors contributing to the underrepresentation of marginalized groups in STEM fields, informed by data gathered by outside consultants (Drs. Aris Winger and Rochelle Gutiérrez) from our students via a survey and focus groups. Led by Dr. Winger (Georgia Gwinnett College), the workshop addressed issues such as stereotype threat, implicit bias, and institutional barriers that impact student persistence and success; and particularly allowed faculty members to examine their own roles in students' positive and marginalizing experiences. The Department's focus is on building faculty awareness and competence in handling these sensitive but crucial topics, fostering a departmental culture that actively works against exclusionary practices. This focus on faculty professional development is essential, as research indicates that faculty-student interactions significantly influence student outcomes in STEM fields, particularly for underrepresented students.

[1] We use the term Latin* as a gender-inclusive default term when referring to members of the Latin American diaspora.

B. **Introduction to the Rehumanizing Mathematics framework** for improving classroom instruction and students' sense of belonging in the Department community. Working in a three-day workshop with the author of the framework, Dr. Rochelle Gutiérrez (University of Illinois), the Department faculty examined their practice through the lens of the framework's eight dimensions (Participation/positioning, Cultures/Our/Theirstories, Windows/Mirrors, Living Practice/Futures, Broadening Mathematics, Creation, Body/Emotions, Ownership/Stewardship). Some dimensions are relatively easy entry points for faculty members working to break away from limiting paradigms: In the Mathematics and Statistics Department's first year of the pathway, most lesson study teams (see below) focused on Windows/Mirrors as a dimension to build around; in year two, many more dimensions were engaged.

   The Rehumanizing Mathematics framework ties into the Department's broader goals of equity and inclusion by challenging the traditional, often exclusionary, structures of mathematics education. It aligns closely with Culturally Responsive Pedagogies by acknowledging the cultural and social dimensions of learning and explicitly working to dismantle the barriers that prevent students from succeeding in STEM.

C. **Lesson Study for Instructional Improvement:** One of the innovative features of the TIPS Pathway is the introduction of **Lesson Study**, a professional development process borrowed from Japanese educational practices, in which faculty collaboratively plan, observe, and analyze lessons to improve teaching and learning. In the context of mathematics instruction at Sonoma State, lesson study serves as a collaborative tool for faculty to implement the Rehumanizing Mathematics framework in their teaching.

   During a lesson study cycle, faculty work together to design a specific lesson with clear learning goals, particularly focused on addressing challenges that underrepresented students may face. One faculty member teaches the lesson while others observe. Afterward, the group engages in a reflective discussion on the lesson's effectiveness, considering both the students' engagement and the equity of the learning outcomes. The lesson is then taught again by another member of the team. This iterative process allows faculty to continuously improve their teaching practices, making adjustments based on real-time student feedback and outcomes.

   The lesson study model emphasizes shared responsibility for student success and fosters a supportive community of practice among faculty. It also provides a structure for long-term, sustainable pedagogical innovation that extends beyond individual instructors to create a department-wide commitment to inclusive teaching.

Lesson Study Teams 2021–24

Because the TIPS lesson study effort involved so many Department faculty and illustrates the Department's impact across other STEM departments, we include here a listing of all TIPS lesson study teams' efforts.

When	Dept & Class	RH dimension	Content	Summary
2023–24	BIOL 131	Body and Emotion	Science Language and Mapping Life	LANGUAGE and ICEBREAKER. This activity introduces root words commonly used in biology, and allows students the opportunity to start getting to know one another. MICROSCOPY DEMO to introduce the use of microscopes, and give students the opportunity to look at various types of organisms under the microscope. FIND YOUR TEAM, where students will be given cards, each of which features an organism that might be found in pond water. They need to determine which domain their organism belongs to (Bacteria, Archaea, or Eukarya), and find the others in the class who are in the same domain.
2023–24	CHEM 105	Windows and Mirrors	sig figs, dimensional analysis, precision v. accuracy	Case study in chemistry for nursing majors, giving presentation data for incoming patient and using that context to explore precision and its importance.
2023–24	GEOL 304	Windows and Mirrors	Understanding primary geologic literature: A Death Valley Jigsaw	Students will read a geologic paper written by a Latin* author, based on a geologic area that they have visited on a field trip (Death Valley). Each group of three students will be given a specific section of the paper to discuss. They will then switch groups in a jigsaw fashion (one person from each section will join a group of 5) and they will share their findings with their new groups, before reporting out to the class.
2023–24	PHYS 209A	Participation	Projectile motion	Students will design their own projectile motion experiment
Spring 2022	Math 161	Windows and Mirrors	intro to integration	Students describe their trip to school, draw velocity graph, find area under curve to determine distance traveled
Spring 2022	Math 165	Windows and Mirrors	Exploring First Generation Identity in SSU/CSU College Student.	Students explore what it means (to them) to be first generation and what assets this brings. They then compare proportion of first gen students at CSU and SSU. Parse out relevant information from dense problem statements. Know what each dot on a randomization distribution represents. Recognize whether the class statistic is unusual or typical compared to the CSU parameter.

When	Dept & Class	RH dimension	Content	Summary
Spring 2022	Math 165	Windows and Mirrors	compare pass rates in Math 165A pre and during pandemic.	Develop an intuitive understanding of the meaning statistical significance and to motivate the concept of a measure of statistical significance (p-value) using pass rate data from Math 165A.
Spring 2022	Math 220 (+ CS 242)	Body and Emotion	complete induction	Better understanding of Proof by Induction and introduction to Complete Induction through a physical demonstration of the idea of induction: Getting to know you dinner
Spring 2023	Bio 131 lab	Windows and Mirrors	angiosperm	Plant Connections and Memories (Windows & Mirrors) Plants and their Pollinators (Body & Emotion) Personal Identities & Plant Connections (Our stories/Their stories)
Spring 2023	Chem 115B	Cultures & Our/ Theirstories	buffer lab, acidification of ocean	Personal connection with and cultural importance of the ocean. Acidification of the ocean: how does changing ph of water change mass of calcium carbonate chips. Students will explore how solutions, buffered and not buffered, vary in pH and pH effect on shells. This will be connected to the buffer system of the ocean as well as reflecting on the importance of shells in their own lives as well as in the lives of the local indigenous cultures.
Spring 2023	CS 115/215	Windows and Mirrors	object oriented programming	Introduces students to the concept of objects, and the syntax (in the focus language of the course, either Python or C++) for defining classes and using classes. Employing objects as an exercise in windows & mirrors will allow students to recognize the domain knowledge they have, how objects are intended as a tool for expressing knowledge, and that there may be common knowledge/interests among peers that serves as a connection to build attachment/community

When	Dept & Class	RH dimension	Content	Summary
Spring 2023	Geol 102	Body and Emotion	Utilizing Body and Emotions to teach Topographic maps	The students will learn the basics of understanding topographic maps without ever looking at an actual topographic map. They will first use pacing, a compass, and a campus scavenger hunt to learn how to navigate a 3D world using a 2D map. Using some 3D models, they will figure out how to represent the 3D world on 2D topographic maps. They will then learn to create their own topographic maps by using information provided in 2D and by using the 3D augmented reality sandbox. A slideshow of inspirational artwork displaying 2D images that represent 3D images will scroll in the background as they work. The goal of this is to help students recognize that anything that is 3-dimensional can be represented in 2 dimensions, which it is hoped will motivate them to engage in the activity. We will finish with a survey reflection of the activity.
Spring 2023	Math 161	Cultures and Our/ Theirstories	intro to optimization	Investigate changing daylight hours throughout year and its cultural significance. Using example of daylight hours to define max/min/inflection point and connect with meaning in real life context. Find connection between max/min/inflection points and zeroes of first and second derivative
Spring 2023	Math 165	Ownership/ Stewardship	signature project	Second Part of the Project was chosen for Lesson Study Preliminary Brainstorming assignment on “meaningful” topic Part 1: Students brainstormed “meaningful” topics Part 2 (Lesson Study Day): Students focus on writing their ideas statistically At the end of the Lesson, Students will be ready to collect their data
Spring 2023	Phys 116, Phys 209A	body and emotion	moments of inertia lab	students experience different types of rotations before table top lab; spinning stool, swinging hammer, rotating arm/torso with weights at different locations

Impact and Future Directions

The research arm of TIPS has helped to identify features of students’ undergraduate experiences that lead to feelings of belonging or marginalization in mathematics and statistics. The findings make it clear that, while the TIPS pathway has led to much greater awareness and

deeper efforts on the part of faculty, it has not “fixed” everything. It is clear that efforts to disrupt centuries of exclusionary practices in STEM will be a never-ending task. The Department plans to continue building on the TIPS Pathway effort through ongoing lesson studies and feedback from both students and faculty, with the long-term goal of institutionalizing these practices across the university and beyond.

The TIPS initiative aligns closely with the university’s strategic priorities, particularly its commitment to Student Success and Academic Excellence and Innovation, as outlined in Sonoma State’s Strategic Plan. By fostering an inclusive and supportive learning environment, TIPS contributes directly to improving student retention, graduation rates, and overall academic success, particularly for Latin* and other historically marginalized students in STEM fields.

The TIPS Towards Justice program represents a transformative approach to mathematics and STEM education at Sonoma State University. Through its focus on culturally responsive teaching, evidence-based pedagogies, lesson study, and rehumanizing mathematics, the program is creating more inclusive and equitable learning environments that support the success of all students, particularly those from underrepresented groups.

Beyond the Classroom

The Department of Mathematics and Statistics at SSU is deeply committed to fostering an inclusive, supportive, and academically enriching environment for all students, with a particular focus on building community and broadening participation in mathematics and statistics. This commitment is realized through various initiatives and programs that extend beyond the classroom, offering students opportunities for personal growth, research engagement, and support throughout their academic journeys.

The TIPS Pathway seeks to transform not only pedagogical practices but also department culture. In alignment with SSU's designation as an HSI, TIPS focuses on fostering inclusivity and creating a sense of belonging for all students, particularly those from historically marginalized communities. The TIPS Pathway encourages faculty and staff to actively advocate for students as they navigate academic barriers and opportunities, helping them build resilience and success in a supportive environment. In addition, TIPS promotes interdepartmental and cross-divisional collaboration, ensuring that students have cohesive and positive experiences across the university. Through this pathway, the Department aims to create a community that embraces diversity and equity, empowering all students to thrive both academically and personally.

The Department also offers students a welcoming space in the Math Lab (and its extension, the Math Deck), which serves as a hub for collaborative learning and community building. In this space, students work together on coursework, hold club meetings, and build meaningful connections with their peers. Many faculty members have embraced the practice of holding student hours (formerly called office hours) in the Math Lab or in the nearby Darwin Lobby. This practice has contributed to the development of a more approachable and supportive academic

environment, with these spaces frequently filled with students working together, engaging with faculty, and receiving guidance on their coursework.

The Department has a long tradition of its weekly M*A*T*H Colloquium series. Started in 1974, and held continuously even throughout the pandemic, the series features weekly talks by mathematicians and statisticians from across the region and many areas of expertise. The lecture series exposes students, faculty, and the general public to innovative research and expository talk and allows students to connect with a diverse group of people. Students are invited to join the speaker for dinner after the talk and the Department regularly hosts pizza parties for all students after the talks as well.

Opportunities for student research are another integral part of the Department's efforts to support learning beyond the classroom. For example, the Mathematical Epidemiology Research Group (MERG), led by Professor Omayra Ortega, provides 5–7 students each semester with the opportunity to engage in meaningful research on societal issues of current interest. Students in MERG conduct original research, prepare papers, and present their findings at conferences, gaining valuable experience in both academic research and professional communication. In addition to MERG, students engage in research through courses such as the Statistical Consulting class (Math 367/467) and through independent studies with faculty members. The Department's commitment to undergraduate research has been reflected in the recognition of its students: since the last program review, three of SSU's eight prestigious Trustees' Awards (one per year) have gone to Mathematics and Statistics majors, further highlighting the Department's investment in student research and other opportunities.

In conjunction with the TIPS Pathway, the Department has strengthened its coordination with MESA (Mathematics, Engineering, Science Achievement), a program that provides targeted support for STEM students, particularly those from historically marginalized backgrounds. The Department's work with MESA, alongside its decades of leadership of SSU's Louis Stokes Alliance for Minority Participation (LSAMP) program, demonstrates a sustained commitment to broadening participation and ensuring that all students, regardless of background, have access to the resources and support they need to thrive in mathematics and statistics.

Together, these initiatives reflect the Department's dedication to creating an inclusive and supportive environment for all students. By providing opportunities for collaboration, research, and community building beyond the classroom, the Department helps students not only succeed academically but also develop the skills, confidence, and networks necessary for success in their future endeavors.

Previous Program Review Progress

The 2016 program review for the Department of Mathematics and Statistics at Sonoma State University, including the Department's self-study and reports from the external reviewer, generated the following list of "Action Items." The School of Science and Technology Curriculum Committee and the School Dean included some additional recommendations in their responses, below.

Action Items from 2016 Executive Summary

Provide a supportive environment for all students that enables success by all students and eliminates achievement gaps for historically underserved groups, in particular women, underrepresented minorities, and first generation students.

Progress since 2016 review:

- Significant progress; see especially TIPS, Stretch Program, and Pedagogical Approaches sections. The Department has also seen significant increases in student participation in supportive programs such as MESA and SACNAS, and significantly diversified its faculty membership through its hires since that review.

Develop a professional development plan that provides opportunities for all instructors to improve their teaching practice.

Progress since 2016:

- The development of the Stretch Program involved significant professional development, including external facilitators and co-teaching models. With Department and School support, multiple faculty members attended the Inquiry-Based Learning annual workshops and summer equity-focused professional development opportunities such as the Park City Math Institute and the annual Critical Issues in Mathematics Education conference at the Simons Laufer Mathematical Sciences Institute at UC Berkeley.
- TIPS Towards Justice included significant professional development activities, including Lesson Study for multi section courses that focused on rehumanizing mathematics dimensions.

Develop a plan that utilizes faculty expertise—especially lecturer faculty expertise—in program coordination and student support.

Progress since 2016:

- The development of the Stretch Program gave many opportunities for lecturer faculty to take up leadership roles in the program. Course coordination has continued to be a role that lecturer faculty sometimes take on.
- TIPS has provided many opportunities for lecturer leadership, including Lesson Study team facilitation and service on advisory boards (e.g. MESA).

Increase opportunities for students to participate in “capstone type” experiences such as research, consulting, preparation for the actuary exam or the subject GRE, and internships.

Progress since 2016:

- The Department’s majors have a much greater emphasis on public presentation and research: Many more students present at the annual SSU Science Symposium (or Research Symposium) and off-campus venues (e.g. SACNAS conference). Professor

Ortega's MERG provides capstone-style research experiences to around six students every year. Our majors have had considerable success in obtaining places at summer Research Experiences for Undergraduates.

- The Department has diversified speakers invited to give colloquium talks (both student and outside) and has invited speakers to talk about their career (and personal) path to where they are. Students have commented to faculty how encouraging it is to hear about speakers' paths.
- The department has increased career and grad school advising: We regularly offer an REU/grad school info session, have created an advising checklist that includes talking to students about plans and opportunities, and have invited students who attended REUs to give talks in the Department seminar.

SSU External Recommendations from 2016 Review Cycle

From the School of Science and Technology Curriculum Committee and the Dean, the Department received positive feedback for its innovative programs and faculty dedication, along with several recommendations.

School of Science and Technology Curriculum Committee

Provide a supportive environment for all students that enables success by all students and eliminates achievement gaps for historically underserved groups, in particular women, underrepresented minorities, and first generation students.

- Progress since 2016: See TIPS and Stretch Program development sections above.

Increase opportunities for students to participate in capstone experiences such as research, consulting, preparation for the actuary exam or the subject GRE, and internships.

- Progress since 2016: As mentioned above, the Department's majors have a much greater emphasis on public presentation and research: Many more students present at the annual SSU Science Symposium (or Research Symposium) and off-campus venues (e.g. SACNAS conference). Professor Ortega's MERG provides capstone-style research experiences to around six students every year. Our majors have had considerable success in obtaining places at summer Research Experiences for Undergraduates.

Dean of the School of Science and Technology

Expand educational assessment processes and practices to include feedback from non-majors beyond Student Evaluations of Teaching Effectiveness (SETE). This is particularly important given that the Department serves so many students outside of their majors. Additionally, assessment must look systematically at how learning objectives are being met beyond student self-reporting to effectively refine courses/programs and improve outcomes.

- Progress since 2016: SSU has significantly bolstered assessment of GE learning objectives since 2016, and the Mathematics and Statistics Department benefits from that annual assessment. Signature assignments have been designed for our GE courses (see section in GE Learning Outcomes above) and used in the annual assessment, helping to provide data beyond the instructor's assessment.

Expand department approaches to supporting differences in student preparation and access to educational opportunities to include Supplemental Instruction (SI). Early steps are already being taken to advance this approach. Also, this should include looking at alternatives to the workshop model currently being used.

- Progress since 2016: See TIPS and Stretch Program Development sections. The previous workshop model has largely been replaced by a modified Supplemental Instruction model ("embedded tutor").

Consider the further transition to using more online homework assessment and learning systems that use adaptive questioning and other dynamic instructional elements as a way to improve student learning outside of the classroom.

- Progress since 2016: The Department has embraced the use of WeBWork, an online locally-hosted open-source homework system (for many 100-level courses), and WileyPlus for the Elementary Statistics classes (stretch and regular). Between them, most students have immediate-feedback homework systems in use for their math courses.

Disseminate the stretch models for GE math through conference presentation and publication, as this is important work of interest to many university educators.

- Progress since 2016: Professors Byrne, Hobson, Kanaana, and Lahme published an article "Stretching Calculus: A Yearlong Calculus Class that Stretches Minds" in the MAA book "Justice Through the Lens of Calculus: Framing New Possibilities for Diversity, Equity, and Inclusion." Drs. Lahme and Shott have consulted with Cal Poly Humboldt as they pursue implementation of the stretch model (adapting our department's curriculum design); and Dr. Lahme has consulted with the University of the Pacific as they design and implement a stretch calculus. Dr. Lahme was a panelist at the April 2025 Just Equations Conference *The Mathematics of Opportunity: Beyond Limits* as part of the session "Where To Begin? Prerequisites, Corequisites, and Calculus Success". Dr. Shott gave a presentation and shared materials and data about the stretch calculus course at the CSU Chairs Council in Fall 2024. Drs. Byrne and Hobson presented a poster titled *Mathematics Stretch Courses: Implementation and Assessment* at the 2020 SIGMAA on RUME Conference and also presented a talk titled *Mathematics Stretch Courses as an Alternative to Remedial Mathematics Classes* at the 2020 Joint Mathematics Meetings.

Continue participation and commitment to the STEM freshman year experience (SCI 120) as part of the School's work across departments and disciplines to provide an interdisciplinary first year course that effectively attracts and retains students.

- Progress since 2016: Professor Shott led the course for several years until the University discontinued funding for this excellent FYE.

Encourage faculty to present and publish their scholarship in curricular and pedagogical advancement.

- Progress since 2016: The Department values such publications very highly and both TIPS and the Stretch Program have led to several publications, conference presentations, and blog posts about pedagogical efforts.

Look into the External Reviewer's recommendation regarding possible alternatives to Mathematica that better align with tools used in other programs/departments (e.g. MatLab).

- Progress since 2016: The open-source statistical software R has replaced previous commercial software and its use in the Department has expanded greatly. The Department continues to explore replacements for Mathematica. With a significant embedded effort in materials development, it will be a major effort to switch to something open source like SageMath. Additionally, there is not a consensus software package in the sciences; switching our programs to MatLab would align better with some disciplines and less well with others.

Prioritize hiring a permanent faculty member to help support the statistics programs over other areas in the Department.

- Progress since 2016: Professors Gaitan and Ortega were hired in 2018 and have made important contributions to the Statistics programs, and both have since been promoted to associate professor positions.

Course & Learning Outcomes Alignment

The Department of Mathematics and Statistics ensures alignment between individual courses and the program learning outcomes (PLOs) through a combination of structured curricular design, departmental coordination, and shared resources. This alignment is facilitated by faculty consensus on course outcomes and content, coordinated assessment efforts, and shared instructional materials.

Departmental Agreement on Course Content and Outcomes

The Department maintains consistency across course offerings by adopting standardized learning outcomes and curricula, ensuring that each course contributes effectively to the broader PLOs. For example, calculus courses follow department-adopted outcomes that align with foundational mathematical competencies expected of all students. Similarly, the statistics committee oversees the development and alignment of learning objectives for statistics courses, ensuring consistency across sections and coherence in student progression.

Course Sequencing and Learning Progression

The Department employs a structured curriculum map to ensure students engage with program learning outcomes at appropriate stages in their academic journey. Foundational courses introduce core mathematical and statistical concepts, which are reinforced and expanded in advanced coursework. For example, introductory statistics courses incorporate hypothesis testing and data analysis skills, which are further developed in upper-division courses like statistical modeling and consulting.

Standardized Teaching and Assessment Practices

To maintain alignment and consistency across multiple sections of the same course, the Department employs:

- Common Canvas Courses: Faculty share and use a departmental Canvas page containing standardized course materials, assignments, and instructional videos.
- Common Textbooks: Multi-section courses, including Elementary Statistics and Calculus, utilize common textbooks to ensure uniformity in content delivery.
- Shared WeBWork Assignments: WeBWork, an online homework platform, provides consistent problem sets and automatic feedback, reinforcing key learning outcomes across sections.

Course Coordination and Resource Sharing

Course coordinators play a crucial role in ensuring alignment by overseeing curriculum implementation, organizing faculty discussions, and maintaining standardized assessments. In statistics, for example, the coordinator manages the common final exam for MATH 165, ensuring students in different sections are assessed equitably. Additionally, the Department fosters a culture of collaboration, where faculty contribute and access shared teaching resources, such as course workbooks and instructional videos.

Math Education Coordination and Pedagogical Innovations

The Department also places a strong emphasis on effective teaching strategies and curricular innovation. Lesson Study, a collaborative faculty initiative, has been instrumental in refining instruction in courses like Elementary Statistics. Faculty members observe and refine lessons to enhance student engagement and conceptual understanding. This continuous improvement process aligns course instruction with the Department's broader goals of fostering critical thinking, quantitative reasoning, and effective communication.

In summary, the Department of Mathematics and Statistics ensures alignment between individual courses and program learning outcomes through structured course sequencing, standardized instructional materials, course coordination, and a culture of faculty collaboration. These efforts collectively enhance student learning and ensure that graduates meet the Department's educational objectives.

	Program Learning Outcome →	C1	C2	C3	C4	M1	M2	M3	M4	S1	S2	S3	S4	GE 1	GE 2	GE 3
Math	**Course Title**															
103	Ethnomath													x	x	x
105	Math & Politics													x	x	x
111	Symmetry													x	x	x
131	Finite Math	x	x	x	x				x					x	x	
141	Studies in...													x	x	x
150	Modern Geometry													x	x	x
161	Calculus 1		x	x	x	x	x		x					x	x	x
165	Elementary Statistics	x	x	x	x	x	x		x	x	x	x		x	x	x
180	Mathematica		x	x	x		x		x							
211	Calculus 2	x	x	x	x	x	x		x							
220	Proof and Reasoning	x	x	x	x	x	x	x	x							
222	Elem. Lin. Algebra		x			x			x							
241	Diff eq and Lin Alg		x			x	x		x							
250	Prob. & Stats. for Teachers	x	x	x	x	x				x	x	x				
261	Multivariable Calc	x	x	x		x	x	x								
300A	Elementary Number Systems	x	x	x	x	x								x	x	x

	Program Learning Outcome →	C1	C2	C3	C4	M1	M2	M3	M4	S1	S2	S3	S4	GE 1	GE 2	GE 3
Math	**Course Title**															
300B	Data, Chance, and Algebra	x	x	x	x	x	x									
306	Number Theory		x		x	x		x								
308	College Geometry	x	x	x	x	x	x	x	x							
310	History of Math	x	x	x	x	x	x	x	x							
316/416	Graph Theory and Combinatorics		x	x	x	x	x		x							
320	Modern Algebra	x	x	x	x	x	x	x								
322	Linear Algebra	x	x	x	x	x	x	x								
340	Real Analysis	x	x	x	x	x	x	x								
345	Probability Theory		x			x	x		x				x			
352	Numerical Analysis		x			x	x	x	x							
367/467	Stats consulting	x	x	x	x					x	x	x	x			
381	Computing for Stats	x	x	x	x					x	x	x				
390	Fieldwork	x		x			x		x							
418	Topology		x	x		x		x								
420	Modern Alg. II		x	x		x		x								
431	Advanced Partial Diff. Eq.			x				x	x							

	Program Learning Outcome →	C1	C2	C3	C4	M1	M2	M3	M4	S1	S2	S3	S4	GE 1	GE 2	GE 3
Math	**Course Title**															
440	Real Analysis II		x	x		x		x								
445	Math. Stats & OR		x			x							x			
460	Complex Analysis		x	x	x	x				x	x	x	x			
465	Exp. Design & Regression	x	x	x	x	x	x	x	x	x	x					
470	Math And Stats Modeling	x	x	x	x				x					x	x	x
490	Capstone Seminar	x		x			x	x								

General Education

Coordination Across Course Sections

The Department's coordinated approach to GE courses ensures consistency and quality across multiple sections, notably in high-enrollment courses like Elementary Statistics and Calculus. The Elementary Statistics coordinator facilitates regular discussions among faculty, oversees the writing of a common final exam, and manages the procurement of standardized classroom materials. This coordinated effort guarantees that students receive a uniform learning experience, enabling equitable assessment of student outcomes across sections. In Calculus, instructors use shared resources—including workbooks, Canvas pages, and videos—to maintain alignment on learning objectives. Regular meetings further provide faculty with opportunities to discuss learning goals, troubleshoot instructional challenges, and exchange effective teaching practices, creating a coherent and supportive learning environment for students.

Signature Assignments in GE Courses

Signature assignments have been developed across GE courses within the Department, providing students with opportunities to demonstrate mastery of GE learning goals through

hands-on projects and assessments. For instance, the Elementary Statistics course (Math 165) includes a signature assignment developed in a TIPS lesson study cycle. This assignment, crafted through collaborative design by faculty, asks students to develop their own hypothesis testing project on a topic of personal significance. The project nurtures student ownership and stewardship by encouraging learners to select meaningful subjects—such as social justice, environmental concerns, or mental health—and apply statistical analysis to investigate these issues. This exercise not only builds statistical reasoning but also helps students to see statistics as a tool for exploring and addressing real-world issues.

Stretch Program for First-Year Students

One of the Department's most impactful recent innovations is the implementation of the "Stretch Program." Initiated prior to the California State University (CSU) system-wide mandate to eliminate developmental courses, the Stretch Program aims to support underprepared students in meeting quantitative reasoning requirements within their first year of college. This year-long GE sequence includes four year-long courses: Finite Math for Business (Math 131A/B), College Geometry (Math 150A/B), Calculus I (Math 161A/B), and Elementary Statistics (Math 165A/B). By extending these courses over two semesters, the Department has been able to embed transition-to-college skills, allowing students to adjust to college-level expectations while progressing toward fulfilling GE requirements.

In the Stretch Program, courses employ active learning and collaborative projects, with a unique structure that supports the varied needs of incoming students. Classes are capped at 30 students, facilitating meaningful instructor-student interactions, and semester one is graded on a Credit/No Credit basis to reduce performance anxiety. The second semester, graded conventionally, enables students to earn B4 GE credit, with learning community mentors offering additional weekly support outside of class. These mentors, who attend all classes and provide tutoring, help to foster a supportive environment and enhance students' sense of belonging in mathematics.

Disciplinary Changes

The primary changes in the discipline that we foresee affecting our programs and curriculum include the emergence of data science as a discipline, impacts of artificial intelligence (AI), evolution in appropriate technology, and changes in demand for our different programs. As these are future directions that the Department is (for the most part) not yet settled on, for most of them we have questions we are wrestling with, rather than answers.

- Data Science: As a growing area of interest and need, we anticipate a new data science major to be a major focus for the Department over the next five years. Currently beginning the faculty governance review process, this major has been developed under the leadership of Prof. Ortega, in collaboration with the Philosophy and Computer Science Departments.

- Artificial intelligence: How does the widespread availability of generative AI affect what our graduates need to know and be able to do? How does it change the ways we expect students to learn those skills and understandings, and the ways we assess them?
- Appropriate technology: As good open-source alternatives to Mathematica and SAS mature, will we move away from these high-cost platforms? To what extent is experience in specific industry-standard technology platforms important, vs. a broader ability to navigate, use, and interpret mathematical and statistical software?
- Changes in demand: The drop in enrollment in our secondary teaching and pure mathematics concentrations has been dramatic since the beginning of the pandemic. Demand for secondary math teachers remains high, and teachers rate their lives highly. Can we do more, in cooperation with the School of Education, to introduce people to teaching as an attractive option? In the pure mathematics concentration, can we perhaps invite students into mathematical exploration in ways that feel more authentic to them (as opposed to ivory-tower "life of the mind" experiences)? One promising possibility to address both issues is lessons from the MAA's META Math project (Mathematical Education of Teachers as an Application of Undergraduate Mathematics).

Assessment of Mathematics and Statistics Programs

We do not have significant assessment data specific to the two types of majors in the Department (mathematics and statistics), so the two are addressed together in this section.

Assessment of program learning outcomes

As a reminder, the Program Learning Outcomes—described in more detail earlier—are briefly recapped here:

Common to All Programs

1. **Critical Thinking & Ethical Conduct**
2. **Problem Solving**
3. **Communication in the Discipline**
4. **Collaboration in Diverse Teams**

Mathematics Programs (B.A. Mathematics, B.S. Mathematics, B.A. Bi-disciplinary Mathematics)

1. **Mathematical Justification**

2. **Breadth of Mathematics & Mathematical Connections**.
3. **Mathematical Depth**
4. **Mathematics as a Tool in Other Disciplines**

Statistics Programs (B.A. Applied Statistics, B.S. Statistics)

1. **Statistics and Data Science as an Iterative Process**
2. **Generating Questions in Statistics**
3. **Data Analysis and Statistical Software**
4. **Mathematical and Probabilistic Foundations**

For each PLO, we briefly mention department efforts outside of specific courses, and highlight relevant feedback from alumni surveys and graduating student exit surveys. Neither survey asked specific questions about the PLOs, so relevant quotes were generated by the respondents in response to generic “feedback about the Department” prompts.

C1. Critical Thinking & Ethical Conduct

Goal: Students will understand different types of reasoning used to make conclusions in the discipline, including identifying coherent arguments and weaknesses. They will demonstrate responsible and ethical conduct in their interactions with colleagues and in selecting, formulating, and analyzing questions.

Findings:
Graduating seniors generally reported confidence in their ability to evaluate logical arguments, with many citing coursework that required them to rigorously justify their reasoning. However, alumni and graduate responses did not comment on ethical conduct in the discipline. One alum noted:

"I feel that SSU helped me with my math thinking and gave me a stronger brain when it comes to understanding the way (sic) and explaining math, that has helped me in my career as a math teacher" (Alum)

Overall, alum and graduating student feedback suggests that while reasoning skills are well-developed, the curriculum could benefit from incorporating more discussions about ethical issues in data science and mathematics.

C2. Problem Solving

Goal: Students will be able to assess and interpret complex situations, choose among several potentially appropriate mathematical or statistical methods of solution, persist in the face of difficulty, and present solutions that include appropriate justification for their reasoning.

Findings: Mathematical and statistical problem solving is at the core of all department curriculum. Students encounter mathematical and statistical ideas in the context of meaningful problems, with the techniques developed as a means to solving those problems.

Exit survey responses suggest that students felt well-prepared to approach complex problems and persist in finding solutions. A vast majority of alumni felt very well-prepared for graduate or professional education (89% scores of 4 or 5). Math and statistics problem-solving skills are broadly applicable beyond explicitly quantitative fields. One alum commented:

"As a teacher, I taught public school math and used my math and statistics training as a public school administrator especially as part of my job as a School District Superintendent." (Alum)

Some alums and graduates noted that while they could apply problem-solving skills effectively, they would have benefitted from more exposure to open-ended, real-world problems. One alumnus working in data science mentioned:

"The math and stats department could improve greatly by adding an internship and/or research course into the curriculum where students can apply what they've learned to helping a business solve some problem, or get formal research experience before grad school." (Alum)

This feedback suggests an opportunity to incorporate more case studies, project-based learning, or internships, with less-structured problem definitions.

C3. Communication in the Discipline

Goal: Students will be able to effectively communicate mathematical and statistical concepts to diverse audiences, adapting their presentation style as needed.

The Department emphasizes communication at every level. The policy on active learning makes student communication of mathematical and statistical ideas central to all classes. Students in advanced classes present annually at a department colloquium, and many advanced students present work in the SSU Research, Scholarship, and Creativity Symposium and other professional presentation opportunities.

Findings: The few alum surveys that discussed communication explicitly were related to teaching:

"I felt that all my math courses at SSU were great at preparing me for math post graduation [and have helped me at] explaining math, that has helped me in my career as a math teacher" (alum)

“I had excellent professors who recognized my love of math and encouraged me to focus my skills on math and teaching. I worked for one of the professors, and he even allowed me to teach a class which I was enrolled if he was out, and it confirmed my desire to teach.” (alum)

C4. Collaboration in Diverse Teams

Goal: Students will be able to work collaboratively in diverse teams, leveraging different perspectives to solve complex problems.

Findings: Again, the Department’s active learning focus means that students have extensive experience working with teams of fellow students.Many advanced classes are team-based; for example, Statistical Consulting students work as consultant teams to produce statistical reports for community clients.

Alumni responses indicate that students valued collaborative experiences and appreciated the collaborative culture of the Department.

"I think the Math Lab was a valuable focal point for the Departmental community." (alum)

"The faculty are knowledgeable, the culture is amazing, and the resources offered are next level. I really, really miss being part of the math department community at SSU!" (alum)

M1. Mathematical Justification (Pure, Secondary Teaching)

Goal: Students will be able to read, understand, and construct clear mathematical arguments, including formal proofs, to support their conclusions.

Findings: This is a clear emphasis of the mathematics programs. The course sequencing facilitates increasing complexity and depth of mathematical justification appropriate for different audiences.

For all mathematics majors, Reasoning and Proof (Math 220) serves as an introduction to rigorous mathematical justification. Developed as a critical thinking General Education course (but no longer satisfying that requirement due to shifts in the University GE structure), the course contrasts mathematical proof with other ways of knowing and other forms of argument.

The course sequence in the pure mathematics concentration requires students to take proof courses at the 200, 300 and 400 level. The expectations for rigor, clarity, and maturity increase

as students go through the sequence, approaching a level appropriate for beginning graduate courses.

For students completing the secondary teaching concentration, the portfolio developed in the early field experience course (390) and capstone course (490) helps students think deeply about mathematical justification as it is manifested at different levels of mathematical sophistication and developmental stages. The History of Mathematics (Math 310) is also designed to develop secondary teachers' understanding of mathematical justification in different contexts.

"I think overall the program helped me in my post grad needs with the intro courses helping me to build into my upper division courses and my upper division courses like linear algebra and differential equations and probability helped me to recognize certain terms and concepts in my grad courses." (alum)

"SSU was the best math department I've studied in. I felt that the program balanced rigor and support." (alum)

M2. Breadth of Mathematics & Mathematical Connections (Bi-disciplinary, Secondary Teaching)

Goal: Students will understand the broad range of mathematical areas and be able to identify and articulate connections between different mathematical concepts.

The Department offers a diverse range of courses that span multiple mathematical disciplines, encourages interdisciplinary study through the bi-disciplinary concentration, and provides opportunities for students to explore applications of mathematics in fields such as physics, computer science, and economics.

Findings: Exit survey and alumni responses indicated that students appreciated exposure to multiple mathematical disciplines. One student noted:

"They encouraged me to reach beyond any expectations I had set for myself, as they believed I could do it. I saw this with all of the students, so I always speak very fondly of the SSU math department." (alum)

"Also, having a program that helps specifically applied math students see how their skills can be applied in real life jobs could be so helpful. There are so many and maybe creating a list to help those find where they can put their passion." (alum)

M3. Mathematical Depth (Pure, Applied)

Goal: Students will develop a deep grounding in at least one area of mathematics or its application, demonstrating expertise and comprehensive understanding in that field.

Findings: Survey respondents specializing in pure and applied mathematics felt well-prepared in their chosen focus areas. Alums commented:

"Also I appreciated how the professors were able to go in depth with the course materials as that helped me to figure out what questions to ask and build on my knowledge." (alum)

“I went into my masters program ahead of the curve.” (alum)

M4. Mathematics as a Tool in Other Disciplines (Applied, Bi-disciplinary)

Goal: Students will understand how mathematics is applied as a tool to solve problems in various other disciplines and be able to use mathematical methods in interdisciplinary contexts.

Findings: Alumni found that the mathematical tools they learned gave them an advantage in further study of other disciplines.

“The bi-di track that I followed has been incredibly important to my education since I have arrived in graduate school. The more advanced mathematical tools that were not discussed in my physics course are often related to or were explicitly taught in the math courses I took at Sonoma State. As an example, group theory has been widely used in my courses. This is a subject I would have had no exposure to if not for the math I took. For any physics student at Sonoma State thinking of going to graduate school I can not recommend the bi-di track in math enough.” (alum)

Alumni and graduating seniors in application-oriented majors felt that having a broad foundation was useful but suggested that more research experiences to tie different mathematical concepts to real-world scenarios would strengthen their preparation.

S1. Statistics and Data Science as an Iterative Process

Goal: Students will understand statistics and data science as an iterative process of extracting insights from data to inform decision-making across various disciplines.

Findings: This is a core learning objective for all statistics courses, beginning with the simulation-based elementary statistics course (Math 165). Exit and alumni surveys both indicate strong confidence in this area.

"I really enjoyed the statistics program and [it] really helped me prepare for my professional life" (alum)

Some alums suggested incorporating more research opportunities into their undergraduate experience.

S2. Generating Questions in Statistics

Goal: Students will be able to formulate statistical questions and critically interrogate data to drive meaningful analysis.

Findings: Students start early on in introductory statistics courses developing their own statistical questions in projects, and continue in subsequence courses. Math 367 Statistical Consulting is a key course in the statistics programs. It gives the students a chance to work with a client in formulating and analyzing statistical questions. In Math 465 Experimental Design and Regression Analysis students design their own studies and present their findings in poster presentations at the SSU Research Symposium.

“I graduated with a full comprehensive understanding of Statistics thanks to the professors and the helpful classmates” (alum)

S3. Data Analysis and Statistical Software

Goal: Students will be able to select appropriate statistical techniques to answer questions of interest, obtain relevant data, and carry out statistical analyses to inform decision-making. They will also demonstrate proficiency in standard statistical software packages and effective data management strategies.

Findings: Exit survey respondents felt some comfortable with statistical software but noted that they primarily used a limited set of tools. Many comments suggested more technology exposure.

"Statistical programming really helped me in my graduate classes, a suggestion would be to focus on using R. I had to extensively learn in graduate school how to use R and STATA as R is free." (alum)

“The only thing I think the stats program needs is an optional SQL class given that was my biggest hurdle post graduation.” (alum)

Alumni working in data science suggested that more exposure to industry-standard tools and data management strategies would be beneficial.

S4. Mathematical and Probabilistic Foundations

Goal: Students will understand the mathematical and probabilistic principles underlying statistical methods, enabling them to apply these foundations to complex statistical problems.

Findings: This goal is emphasized much more in the B.S. than the B.A. In Math 465 Experimental Design and Regression Analysis students design their own studies and present their findings in poster presentations at the SSU Research Symposium.

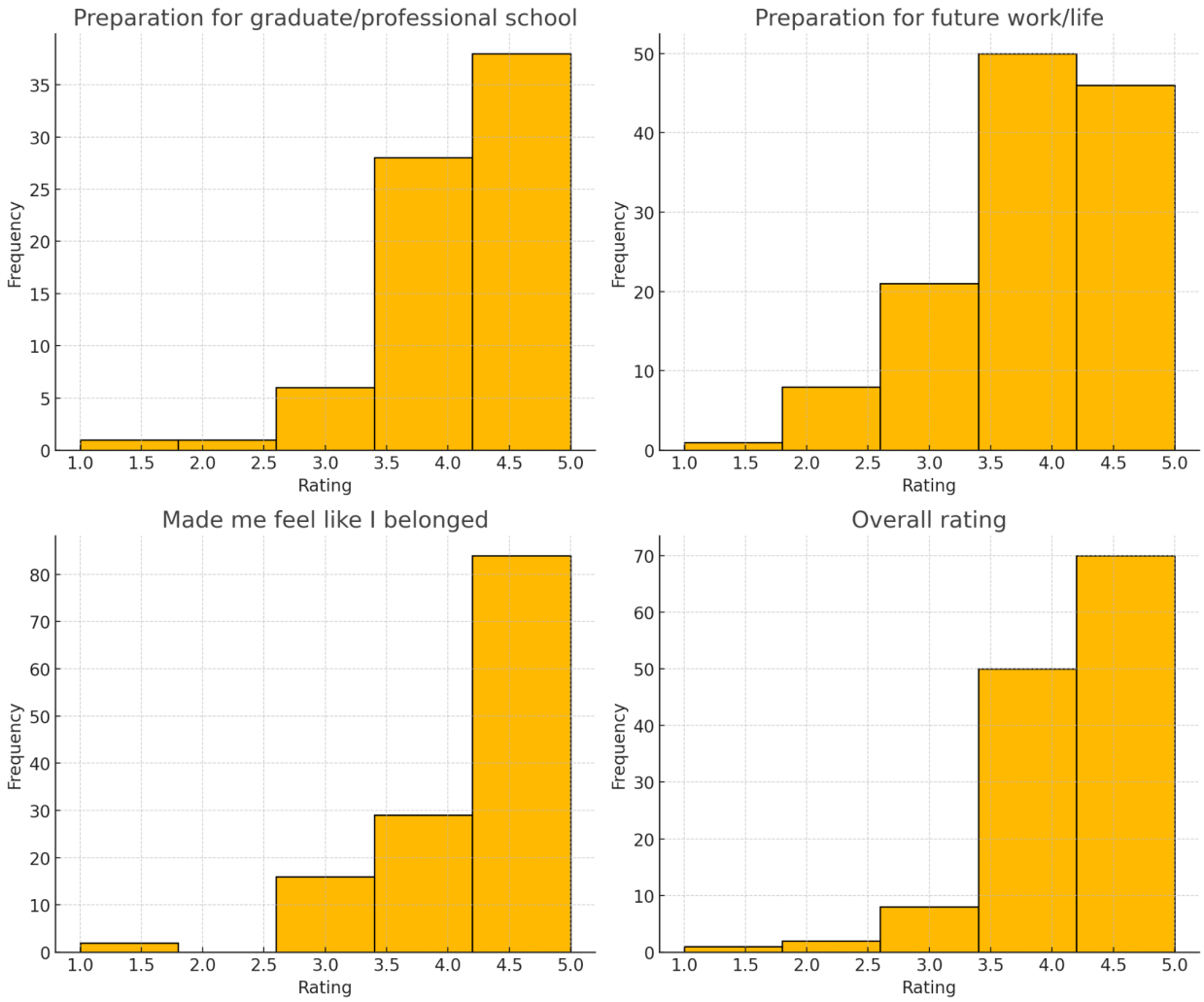
“The transition to graduate school was tough but doable. I needed a little more exposure to real analysis and functional analysis. While I felt good about my abilities to learn new concepts, more exposure to stochastic processes would have been helpful for me based on what I ended up working on in graduate school.” (alum)

Conclusion

Overall, survey responses indicate that students and alumni feel well-prepared in core program learning outcomes. Areas for improvement include more training in ethical issues, a stronger emphasis on research and internships, and using modern statistical programming software. Addressing these gaps through curriculum adjustments and expanded experiential learning opportunities could further enhance student success.

Alumni Survey

The Department emailed all department graduates with known email addresses and received approximately a 20% response rate, with 133 responses. Overall ratings of the Department were very high.



Key correlations

1. **Overall Rating vs. Preparation for Graduate/Professional Education**: There is a moderate positive correlation (0.56) between the overall rating of the Department and how well alumni felt prepared for graduate or professional education. This suggests that those who rated the Department highly also felt well-prepared for further studies.

2. **Overall Rating vs. Preparation for Future Work and Life**: Similarly, there is a moderate positive correlation (0.53) between the overall rating and how well alumni felt prepared for future work and life, indicating that alumni who rated the Department highly also felt well-prepared for their careers.

3. **Preparation for Work and Life vs. Satisfaction with Current Position**: There is a weaker positive correlation (0.36) between how well alumni felt prepared for work and their satisfaction with their current position, suggesting that feeling well-prepared might contribute to job satisfaction.

4. **Overall Rating vs. Job Satisfaction**: The correlation between overall rating and job satisfaction is quite low (0.13), indicating little direct relationship between overall department rating and alumni job satisfaction.

5. **Overall Rating vs. Belonging:** There is a strong positive correlation (0.64) between the question "Overall, how would you rate the Mathematics and Statistics Department?" and "The Math/Stats community made me feel like I belonged." This indicates that alumni who felt a strong sense of belonging within the Department tended to rate it more highly overall. This sense of community appears to be a significant factor in shaping positive perceptions of the Department.

6. **Participation vs. Belonging:** There is a moderate positive correlation (0.48) between alumni participation in Mathematics and Statistics Department activities outside of classes and their sense of belonging within the community. This suggests that greater involvement in department life is associated with a stronger feeling of community and belonging among alumni.

The analysis of ratings based on gender and race/ethnicity revealed the following:

Gender Differences

1. **Preparation for Graduate/Professional School**:
    - Both female (4.41) and male (4.32) respondents rated their preparation similarly, with slightly higher ratings from female alumni.
2. **Preparation for Future Work and Life**:
    - Female and male respondents rated their preparation for future work and life similarly (4.09 for both), indicating consistent satisfaction across genders.
3. **Sense of Belonging**:
    - Both male and female respondents rated the community highly (4.31 for males, 4.16 for females).
4. **Overall Rating**:
    - Female (4.48) and male (4.49) respondents gave similar overall ratings to the Department.

Race/Ethnicity Differences

1. **Preparation for Graduate/Professional School**:

- Ratings were generally high across all racial/ethnic groups, with most groups providing ratings between 4.0 and 5.0.

2. **Preparation for Future Work and Life**:
    - The ratings for preparation for future work and life were also high across groups, ranging from 4.0 to 5.0.
3. **Sense of Belonging**:
    - Ratings were mostly positive, with some variation between groups. White respondents generally rated this highly (4.43), while some mixed-race groups provided slightly lower ratings.
4. **Overall Rating**:
    - Most racial/ethnic groups rated the Department highly, with many giving ratings around 4.2 to 5.0. White respondents rated the Department at 4.49, while Hispanic/Latino respondents rated it at 4.29.

Thus, there were no statistically significant differences in the overall ratings between male and female respondents, with both groups expressing high satisfaction. Similarly, race and ethnicity data showed high satisfaction across most groups, with some variation, but generally positive ratings for the Department. Response numbers for gender nonbinary and mixed-race students are too low to make statistical conclusions, but do indicate that these students will benefit from continued department efforts to ensure that *all* students feel a sense of belonging in the Department community.

Open-ended feedback

Some key themes emerged in the alumni responses to this open-ended question in the survey:

“Please tell us about your relationship with the Mathematics and Statistics Department. We are particularly interested in learning how well your program in math or stats satisfied your post-baccalaureate needs. Do you have any suggestions for how we can improve the program?”

1. **Satisfaction and Praise for Faculty**: Several alumni expressed positive sentiments regarding the faculty's dedication, helpfulness, and approachability. They highlighted the supportive relationships built with professors and appreciated the small class sizes, which fostered meaningful engagement and learning.
2. **Career Preparedness**: Many respondents noted that the program successfully prepared them for their post-baccalaureate needs, including roles in teaching, data analysis, and various industries requiring strong quantitative skills. Graduates emphasized the solid

mathematical and statistical foundations they received, enabling smooth transitions to graduate studies or career paths.

3. **Suggestions for Improvement**: A few respondents provided constructive feedback. They suggested the inclusion of more practical or applied courses to bridge theory and real-world application. Some also recommended enhancing the career support services, particularly in terms of internships or guidance in non-academic career opportunities.

4. **Overall Positive Experience**: Overall, alumni expressed satisfaction with the program and recognized the Department's role in their academic and professional growth. They appreciated the comprehensive curriculum and the opportunities for intellectual development, with some noting that improvements in program flexibility and career services would make the experience even better.

These reflections provide valuable insights for the Department, emphasizing the importance of maintaining strong faculty-student relationships while also considering curriculum updates and career service enhancements to meet evolving alumni needs.

General Education and the Stretch Program

Note on mathematics placements: Prior to 2018, incoming first-year students were placed in three mathematics preparation categories: ELM1: needing one semester of remedial mathematics, ELM2: needing two semesters of remedial mathematics, Non-ELM: ready for college level mathematics. In 2018 the CSU introduced a new placement system. The categories now are M1: already satisfied the GE math requirement, M2: ready for a one-semester GE math course, M3 and M4: needing support to be successful in a college level math course. Broadly speaking M3 corresponds to ELM1 and M4 corresponds to ELM2. At SSU, M3 and M4 students are placed in “stretch courses:” year-long versions of regular GE math courses.

Note on impaction: Since the 2016 program review, SSU changed its admission criteria to the CSU minimum. This means that overall, entering students have lower placement scores now than they did in the past.

Preliminary data suggest that the Stretch Program has positively impacted student success rates, reducing DFW rates compared to previous developmental courses. This reduction in DFW rates reflects the program's success in supporting student retention and progression, particularly for those from traditionally underserved groups. Through these well-coordinated efforts, the Department of Mathematics and Statistics demonstrates a robust commitment to inclusive, high-quality GE education that aligns with SSU’s learning outcomes and prepares students for academic and real-world challenges in a supportive, equitable environment.

One goal of the Department when introducing stretch GE courses was to increase the number of students pursuing and being successful in future mathematics courses. The data in the table

below shows the pass rates of students in their next math class. There are are several points to observe:

- For most courses, students who take the stretch version of a course have similar success rates in their next class as students who take the one-semester course
- The exception is when the “next class” is Calculus 2, Math 211:
    - Students who take the stretch version of Calculus 1 (Math 161A/B) have a 67.1% pass rate in Calculus 2 (Math 211) the next semester vs. 85.8% and 81.3% for students who took the one-semester course (Math 161).
    - However, a much larger percentage of M3/4 students attempt and pass calculus than ELM 1/2 students (8.21% of ELM 1/2 vs 12.25% of M3/4 take calculus. Of those who take calculus, pass rates for ELM 1/2 were 68.5%/63.5% vs. for M3/4 were 84.9%/73.9%).

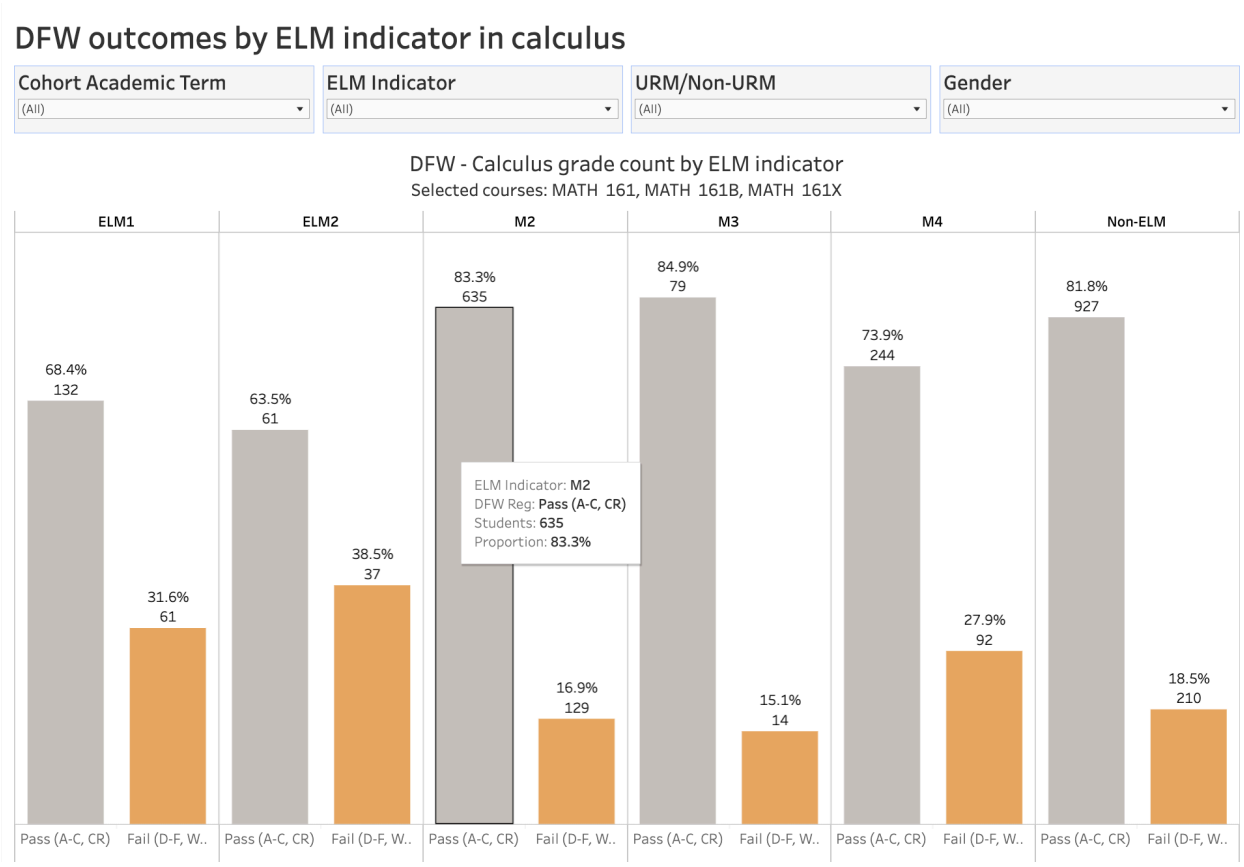
Success in the next math class for students coming from stretch vs. non-stretch:

- Students who took Math 161 had pass rates in Math 211 of 85.8% (calc 1 in first semester) and 81.3% (calc 1 in second semester) in the next semester.
- Students who took Math 161 had pass rates of 80.7% and 85.4% in Math 165.
- Students who took Math 161B had pass rates of 67.1% in Math 211.
- Students who took Math 161B had pass rates of 76.2% in Math 165.
- Students who took Math 165 had pass rates of 89.1% and 87.8% in Math 131.
- Students who took Math 165 had pass rates of 69.2% and 75.3% in Math 161.
- Students who took Math 165B had pass rates of 80.4% in Math 131.
- Students who took Math 165B had pass rates of 70.9% in Math 161.
- Students who took Math 131 had pass rates of 76.8 and 81.3% in Math 165.
- Students who took Math 131B had pass rates 60.9% in Math 165.

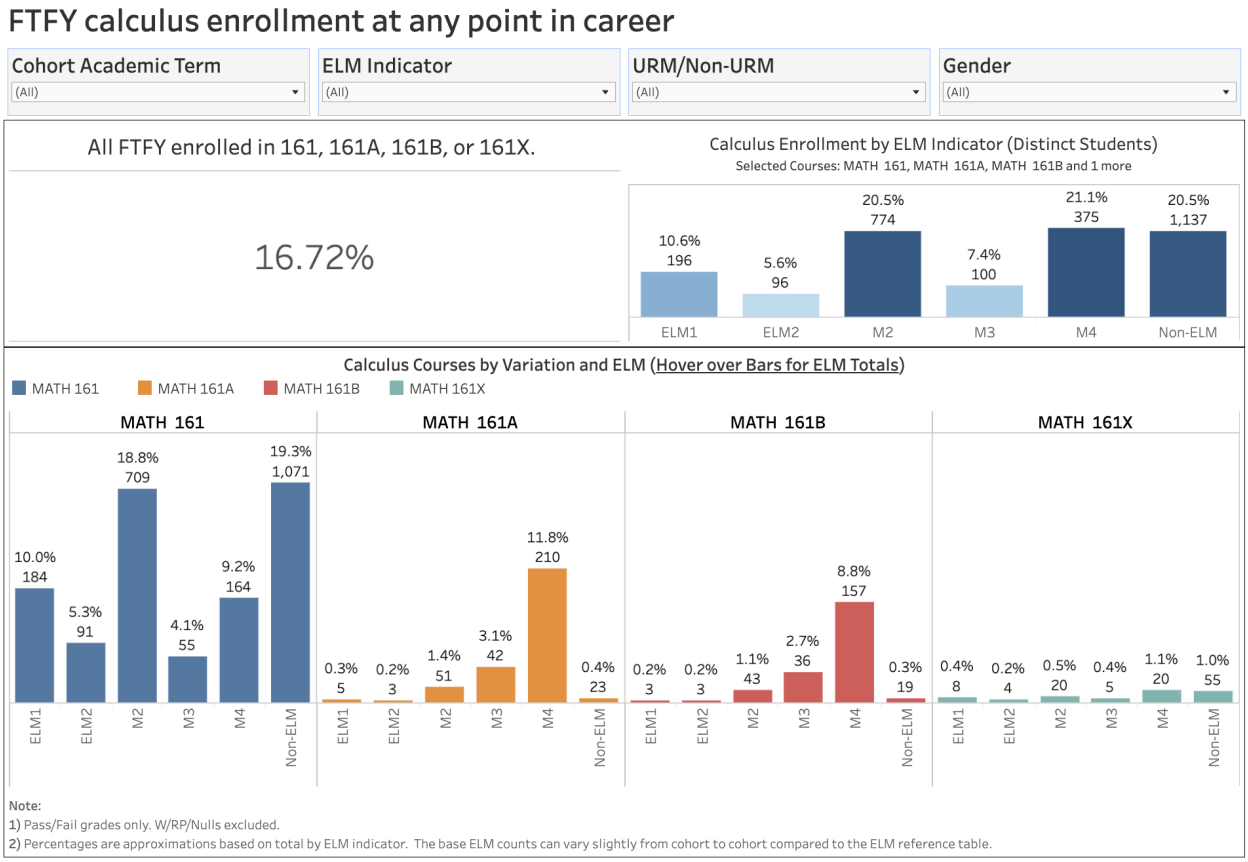
First-year students		Second math class taken (percent is pass rate)			
		131	161	165	211
First math class taken	131 fall			76.8%	
	131 spring			81.3%	
	131B			60.9%	
	161 fall			80.6%	85.8%
	161 spring			85.4%	81.3%
	161B			76.2%	67.1%
	165 fall	87.8%	69.2%		
	165 spring	89.1%	75.3%		

	165B	80.4%	70.9%		

Graphs illustrating impact of stretch program implementation



Above: Comparing calculus pass rates: A significantly higher percentage—and many more by count—of M3/4 students pass Calculus 1 now than did ELM 1/2 students (a roughly equivalent group) in the previous system.



Above: Calculus enrollment: More M3/4 students now take calculus

Assessment of other program goals

The TIPS effort has included significant evaluation and research regarding belonging and marginalization in the mathematics community. As a key department goal, this evaluation and research has contributed significantly to our understanding of instructional and out-of-class experiences that help students persist in our discipline and make it their own. Selected articles and refereed conference presentations resulting from TIPS work are listed below (note that authors López-Bazán and Lewis were SSU undergraduates at the time of writing).

1. Leyva, L. A., Byrne, M. H., Asada, M., Mitchell, N. D., Posada-Castañeda, R., & López-Bazán, R. (2024). Groupwork as a Site for Servingness among Undergraduate Latin* Mathematics Students. In *Proceedings of the 26th Annual Conference on Research inUndergraduate Mathematics Education*.
2. McNeill, R. T., Leyva, L. A., Byrne, M. H., Mitchell, N. D., Lewis, R., & Abreu-Ramos, E. D. (2023). “Looking Outside of my Bubble”: Whiteness-at-Work in Mathematics Faculty Sensemaking about Serving Latin* Students.
3. Leyva, L. A., Mitchell, N. D., McNeill, R. T., Byrne, M. H., Ford, B., Chávez, L. A., & Abreu-Ramos, E. D. (2022). Faculty and student perceptions of instructional servingness in gateway mathematics courses at a Hispanic-Serving Institution. In A. Lischka, E. B.

Dyer, R. S. Jones, J. N. Lovett, J. Strayer, & S. Drown (Eds.), *Proceedings of the 44th Annual Meeting of the North American Chapter of the International Group for the Psychology of Mathematics Education* (pp. 444-452). Nashville, TN. https://doi.org/10.51272/pmena.44.2022.

4. Mitchell, N. D., Leyva, L.A., Lewis, R., & López-Bazán, R. (2023). Be 'shy' or be served: Latin* women's intersectionality through instructional experiences in introductory mathematics courses. Symposium paper presented at the annual meeting of the American Educational Research Association. Chicago, IL.
5. Byrne, M., H., Leyva, L. A., Mitchell, N. D., & López-Bazán, R. (2023). Seeing through windows and holding up mirrors: An analysis of rehumanizing servingness through mathematics instruction. Symposium paper accepted for presentation at the annual meeting of the American Educational Research Association. Chicago, IL.
6. Gutiérrez, R., Lahme, B., López-Bazán, R., Mookerjee, M., Winger, A., Ford, B. (2022). STEM at a Tipping Point. Association for Interdisciplinary Studies Conference. Rohnert Park. CA.
7. Lahme, B. (2023). Windows and mirrors into integration – A lesson study in Calculus I. Presentation delivered at the Joint Mathematics Meetings. Boston, MA.
8. Lahme, B., & Leyva, L. A. (2023). Stretching Math and Minds – Establishing a Year-long Calculus Course for All. Presentation delivered at the Joint Mathematics Meetings. Boston, MA.

The year four TIPS evaluation report is included in the Appendix. One aspect of the TIPS evaluation effort that will yield valuable assessment data is the pre- and post-administration of a department-level adaptation of the Culturally Engaging Campus Environment survey. Prior to the beginning of the TIPS pathway, surveys were administered to students who had taken a math class in the prior year and to mathematics faculty. Both surveys were tailored to evaluate the Department culture around equity and inclusion. The same surveys were again administered in Fall 2024 and the TIPS external evaluator evaluation team from WestEd is currently reviewing the post surveys.

Prior to the 2021 faculty equity workshop that started the TIPS Pathway, PD providers Aris Winger and Rochelle Gutièrrez conducted focus groups with Latin* students about their experiences in mathematics and statistics courses. Representative quotes collected in the focus groups served as the basis of a workshop activity where faculty were confronted with their students' experiences and discussed their own roles and responsibilities. This activity was memorable and effective —to such an extent that we continue to reference these student voices in ongoing discussions, and plan to incorporate similar focus groups in future department evaluation efforts.

Curriculum changes based on assessment

Since the last program review, the Department only made minor changes to the programs and courses offered in the Department.

We changed the grade mode in Math 220 Reasoning and Proof from graded to Credit/NoCredit. The course is the introduction to the upper-division mathematics major, and the bridge course from lower division courses, which are more computational in nature to prepare students for the proof-based upper division major courses. This transition is challenging for many students. Changing the grade mode to Credit/NoCredit allows students and the instructor to focus on mastering the new concepts without the added pressure of maintaining a high GPA.

In 2017 the Department eliminated remedial courses and introduced stretch GE courses. This was ahead of the CSU mandate that eliminated remedial courses systemwide, and was based on an emerging nationwide assessment in the mathematics community that remedial courses form a significant barrier for student success without providing the desired benefit of better preparation for college level mathematics courses.

To comply with Executive Order 1071 from the CSU system chancellor's office, the Department changed the B.A. In Mathematics with a concentration in Bi-Disciplinary mathematics to the B.A. in Bi-Disciplinary Mathematics. The new program increased the number of courses in the core by including Math 470 Mathematical and Statistical Modelling, which also serves as the met-in-the-major UD Area B requirement.

In response to a request from the Hutchins School of Liberal Studies, the Department increased the units of Math 300B Algebra, Geometry, and Data from 3 to 4 units by including a unit of Geometry. Many of the students transferring into the Hutchins program arrive with Statistics already completed as a GE Math course, and require content understanding in Geometry as prospective elementary school teachers.

Future changes to program assessment

The Department will continue to use alumni and exit surveys to assess program learning outcomes. In the future, we will rewrite both surveys to more directly assess the PLOs.

Currently, each major includes courses (e.g Math 440, 460, 420, 465, 470, 485, and 490) that serve as capstone experiences for the different programs and concentrations. These courses' projects attempt to integrate each program's learning goals. We will more formally identify capstone courses for each program and consider how to incorporate these courses into a comprehensive PLO assessment plan.

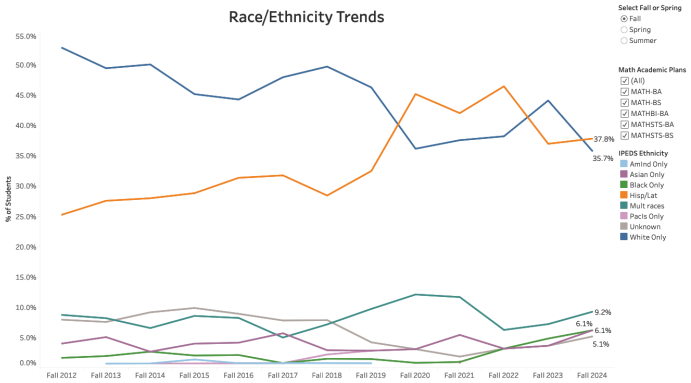
Given that the current faculty workload doesn't provide for extensive formal assessment, the Department will continue to pursue projects that include meaningful assessment efforts while trying to minimize the burden on faculty. These efforts might include collaborating with other departments to conduct student focus groups, an idea identified in the TIPS project.

Faculty

The faculty of the Department of Mathematics and Statistics has a reputation on campus for activism, leadership, and cohesion. Since the University was founded in 1961, the Chair of the

Faculty (University-wide; also chairs the faculty senate) has been from the Department for six of the 61 years, second only to Anthropology at 6.5 years.

Since the last program review, the primary focus of the faculty has been broadening participation and success in the mathematical sciences to all groups of students—particularly groups that are historically underrepresented in the discipline. Many forms of action arise from this focus, highlighted throughout the document. These actions build on a long history in the Department of efforts to improve students' experiences, such as leadership of the Louis Stokes Alliance for Minority Participation (LSAMP) for 20 years, adoption in the 1980s of the "Potsdam model," and early adoption of a Department-wide active learning policy. The embracing of SSU's HSI status has helped the Department achieve significantly greater ethnic & racial diversity (mirroring SSU's overall diversity). The TIPS: Towards Justice project is the most prominent recent example of this Department-wide commitment.



Faculty areas of focus

In addition to the tenured faculty focus areas described below, the Department benefits from an outstanding group of lecturers, who have played leadership roles in the development and coordination of the stretch program, the calculus sequence, and the education of future elementary teachers.

Applied: Martha Shott, Sunil Tiwari, and Elaine Newman's area of expertise is in applied mathematics and they teach most of the upper division courses in the Applied Mathematics BS program. Martha Shott and Sunil Tiwari serve as advisors and conduct research projects with applied math students.

Statistics: Elaine Newman, Omayra Ortega, Susan Herring, and Rodrigo Gaitan primarily teach courses in the Statistics BS and Applied Statistics BA program. The four faculty share advising in the two statistics programs.

Pure/Core: Jerry Morris, Izabela Kanaana, Sam Brannen, Brigitte Lahme, and Ben Ford teach courses taken by pure and teaching majors as well as courses required in multiple programs. In addition, Jerry Morris and Izabela Kanaana teach a variety of calculus courses. Sam Brannen serves as advisor for pure mathematics BA students. Brigitte Lahme serves as advisor for Bi-Disciplinary mathematics BA students. Ben Ford has been mentoring McNair scholars in pure mathematics undergraduate research in recent years.

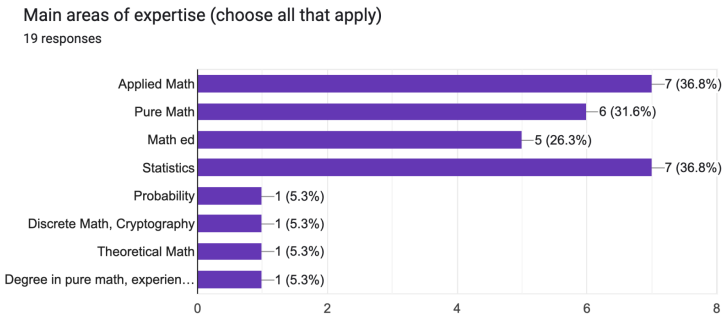
Mathematics Education: Martha Byrne and Ben Ford serve as advisors for future secondary mathematics teachers. Martha Byrne, Ben Ford, and Brigitte Lahme teach courses for elementary education and secondary teaching mathematics majors. In addition, they collaborate with faculty from the College of Education on the mathematics education committee. They also work with local school districts and other education organizations on K12 mathematics outreach, curriculum and policy projects.

Faculty CVs and survey summary

Attached faculty CVs demonstrate broad expertise, contributions, and involvement. Faculty members completed a survey in Fall 2024 about their expertise and contributions. Responses are summarized here; the survey corroborates the wide range of activities of the faculty.

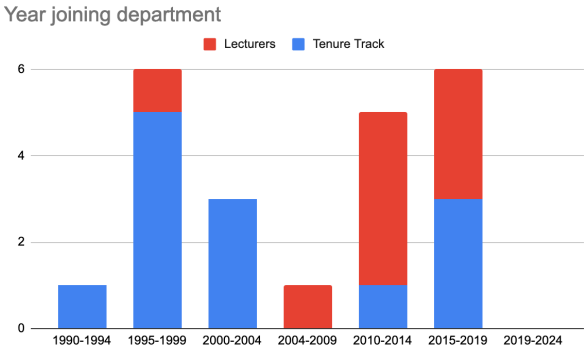
1. Main areas of expertise

- Faculty members reported expertise in diverse fields, including:
    - **Pure Mathematics**: Some specialize in foundational and theoretical aspects of mathematics.
    - **Applied Mathematics**: Many have applied mathematics backgrounds, reflecting contributions to practical and interdisciplinary applications.
    - **Statistics and Probability**: A significant number have expertise in statistics, addressing the needs of the statistics programs.
    - **Mathematics Education**: Focus on pedagogy, teacher training, local schools partnerships, and curriculum development. This area has generated the bulk of the external funding since the last review.



2. When did you join the Department?

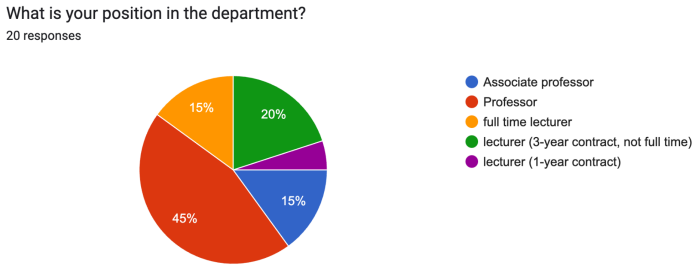
- Faculty tenure spans several decades, with responses indicating:
    - Long-standing members who joined as early as the 1990s.
    - Mid-career contributors from the 2000s.



- Recent hires from the 2010s and 2020s, bringing fresh perspectives.

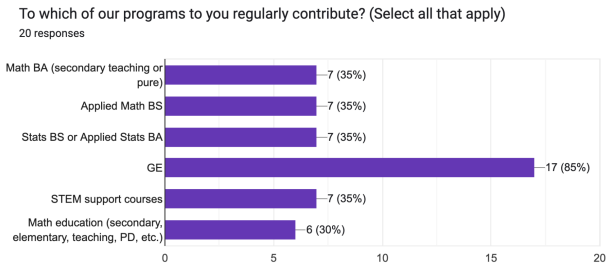
3. Position in the Department and programs contributed to

- **Positions**: Faculty roles include:
  - Professors
  - Associate Professors
  - Full-time and part-time lecturers
- **Programs Supported**:
  - General Education (GE)
  - Mathematics BA (pure and secondary teaching concentrations)
  - Applied Math BS
  - Statistics BS and Applied Statistics BA
  - STEM support courses
  - Teacher education and professional development.



4. Contributions to programs

- Examples of contributions include:
  - **Teaching**: Core and advanced courses across disciplines.
  - **Curriculum Development**: Designing new courses, revising syllabi, and creating resources like digital tools, workbooks, and shared instructional materials.



  - **Student Mentorship**: Advising research projects, guiding career development, and supporting student presentations.
  - **Program Assessment**: Participation in reviews and implementing feedback mechanisms for improving curriculum and teaching methods.
  - **External Funding:** Significant grant funding, especially belonging-focused NSF funding and extensive Math Education funding
  - **Industry Engagement**: Leveraging professional experience to highlight real-world applications of mathematics and statistics.

5. Service and scholarship activities

- Faculty are engaged in multiple service activities, including:
    - **Committee Work**: Departmental, university-wide, and professional organization committees.
    - **Community Engagement**: Participation in outreach programs and lesson studies to enhance K-12 and higher education connections.
    - **Professional Development**: Leading or attending workshops on inclusive teaching practices and other pedagogical innovations.
- **Scholarship**:
    - Contributions to research in mathematics, statistics, education, and interdisciplinary projects.
    - Significant grant-funded activities supporting K–12 math education outreach, applied math research, and postsecondary STEM culture change.

This summary highlights the faculty's wide-ranging expertise, robust contributions to programs, and active roles in service and scholarship, showcasing their commitment to student success and program improvement.

The primary change in faculty composition since the 2016 program review is the addition of Associate Professors Omayra Ortega and Rodrigo Gaitan to the tenure track, significantly bolstering the Department's ability to deliver robust offerings in the growing fields of statistics and data science. Hiring in this area was identified as a top priority in the 2016 self study. Student enrollment and interest in these fields clearly justifies these important additions.

In the current University-wide enrollment decline, it is difficult to ascertain program-level trends, but it seems clear that statistics and applied mathematics programs have sustained student interest. Data science, as an outgrowth of statistics, is an up-and-coming area that the Department is currently planning programs to address. With the most recent hires being in statistics and data science, it is likely that the Department will have a need for future tenure-track contributions in applied mathematics.

The tenure-track faculty in the Department is made up of 3 associate professors, 8 full professors and 1 participant in the Faculty Early Retirement Program. Over the next 5 years, several faculty members are planning to transition into early or pre-retirement time base reductions that will lead to full retirements. The Department needs to develop a plan for future hiring once the current budget crisis eases and current faculty start retiring. There will be a particular need to fill anticipated vacancies in applied mathematics and data science.

Student Faculty Ratio in Instruction

Student enrollment since 2016 has changed dramatically. The FTES taught in the Department have decreased from 550 in 2016-2019 to 330 in 2024. In 2018 the CSU changed the placement of first year students into math courses, which caused a temporary increase in FTES to over 600. The number of faculty changed accordingly. The student-faculty ratio has decreased from over 25 to 20. Beyond the overall University enrollment decline, one reason for this decrease is the elimination of multiple sections of remedial mathematics courses when the

Department implemented the stretch program, leading to students progressing through their GE math requirement with fewer overall units of math courses..

	2016	2017	2018	2019	2020	2021	2022	2023	2024
FTES	552.00	566.60	615.13	550.80	441.85	392.73	360.87	342.78	330.00
FTEF	21.49	22.48	26.55	24.16	19.02	20.21	17.14	16.62	16.70
SFR (FTES/FTEF)	25.69	25.20	23.17	22.80	23.23	19.43	21.05	20.62	19.76

Program Resources

Faculty expertise for teaching

The Department currently has 11 tenured faculty, no pre-tenure tenure-track faculty, one FERP faculty in her third year, and about 8-10 lecturer faculty. With this level of staffing, we are able to teach all courses in our program by faculty with appropriate expertise. Looking ahead, several tenure-track faculty are planning to retire within the next five years, which will lead to significant gaps. With several key tenure-track faculty on leave over the past few years, lecturers have taken on teaching responsibilities for several courses that have traditionally been taught by tenure-track faculty, in particular Intermediate Statistics (Math 265), Mathematical Programming (Math 180), and Computing for Statistics: SAS Programming Language (Math 381). All three classes include mathematical and statistical programming in R, Mathematica, or SAS. As noted in alumni survey summaries, this is an area for investment of energy and resources going forward.

Advising and student support services

Advising responsibilities are divided among the tenure-track faculty in the Department according to their expertise. Statistics faculty advise students in the Statistics B.S. and Applied Statistics B.A., applied mathematics faculty advise students in the Mathematics B.S., pure mathematics faculty advise students in the Mathematics B.A. pure concentration, and mathematics education faculty are advising students in the Mathematics B.A. secondary teaching concentrations. One faculty member is responsible for advising students in the Bi-Disciplinary mathematics B.A. The Department chair is the first person students see for advising before choosing a specific program or minor.

Student research

Several faculty members are engaged in research with undergraduate students. Dr. Ortega has formed the Mathematical Epidemiology Research Group (MERG), which consists of 6–8

members every semester and conducts research in applied mathematics and statistics. Because it is a consistent effort, Dr. Ortega has been able to run a course under the Department's special topics number (Math 485) for the research group. Other faculty members conduct research as independent studies with some students (and sometimes faculty) being funded through MESA or McNair scholarships.

Recent years have seen a number of students participate in summer Research Experiences for Undergraduates (REUs) across the country. Quite a few students have continued on to graduate programs after engaging in these REUs.

Facilities: classrooms, offices

The Department put a lot of thought into the remodeling of the Department office space in 2006, for example guaranteeing that offices without windows have access to shared natural lighting.

The Department has 18 faculty offices, which are accessible from a shared hallway that is also connected to the Department office. With the current level of student enrollment, the space is adequate for the number of faculty. Tenure-track faculty have their own offices while most lecturers share offices with one colleague. When the enrollment was at its peak, some lecturers were assigned to offices in the basement of Darwin Hall, which was not ideal.

Darwin 109 is a dedicated mathematics classroom which is mostly used for courses for future elementary teachers (Math 150 Geometry, Math 300A Elementary Number Systems, and Math 300B Data, Chance, and Algebra). The room is set up for extensive use of group work with hexagonal tables (joining two trapezoids) and cabinets housing many types of manipulatives.

Darwin 108 is the Emmy Noether Math Lab. This is an open study room available to anybody and mostly used by math majors to work together, study, and for meetings of the math club. Since 2023, math students have largely taken over the Darwin Hall lobby, which also serves as the primary MESA study space.

Technology

The main programming and software packages used in mathematics and statistics classes are Mathematica, SAS, and R. Other software programs used are Google Sheets/Excel, Desmos, and Geogebra. There are costs associated with Mathematica and SAS that are subsidized by the CSU system and the dean's office. All other programs are open source.

The Department has used the open online homework system WeBWork for many years. IT was able to install the program on an SSU server so that it could be used for free. We are currently working with IT to update the system to the newest version. This is very necessary because the program is outdated and the available library of problems is insufficient. IT is hoping to update the system in Summer 2025.

Faculty make extensive use of the learning management system Canvas and have developed coordination Canvas courses to share materials for multi-section courses. The Center for

Teaching and Educational Technology is a great resource for faculty needing assistance with Canvas. Many faculty have attended CTET workshops to become more proficient in the use of Canvas.

Faculty have access to work stations through the IT workstation refresh program. The Department is making funds available to upgrade the standard model for faculty who require a better model. During the pandemic, the university provided technology funding which many faculty used to get iPads for instructional use. As the iPads age, there is some concern if the Department will be able to replace failing models. There are some funds available for this purpose (faculty development fund, redirected IDC).

The Department Operating Expense (OE) allocation has not changed for many years. Currently, the amount available is sufficient, especially since electronic resources have taken over paper copies in many ways and since printing costs are now covered centrally. However, in the long term OE should increase to account for inflation.

Historically, the Department has received funding from the dean's office to pay for student assistants, especially graders who help faculty teaching lower division courses grade homework assignments. These funds have decreased over the years. So far, the Department has found ways to continue supporting instructors with graders, but a stable source of funding should be found. Since the Department has almost no costs other than direct personnel, grading is a great way for math majors to gain valuable experience and earn money.

The Learning and Academic Resources Center (LARC) offers extensive free tutoring and employs many mathematics and statistics majors. LARC also trains and supervises embedded tutors who are student assistants in many stretch math courses.

The Department is supported by one administrative coordinator. Over the past years, many administrative procedures have moved to electronic platforms which has resulted in administrative tasks that were done by the AC shifting to individual faculty members, i.e. travel and hospitality reimbursements. For faculty who do many of these tasks (hosting speakers, representing SSU at conferences, etc.), this has meant a significantly increased workload.

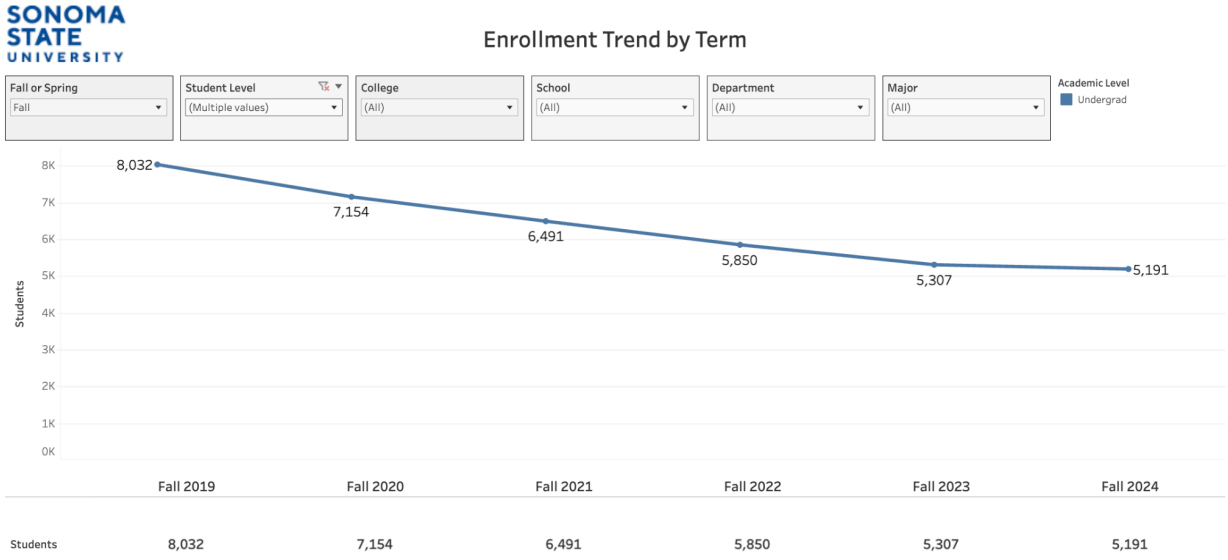
Student Success

Since the last program review, the enrollment in mathematics and statistics major programs has reflected the general trend at SSU. The number of majors stayed stable until 2020 and then decreased to a low of 84 in fall 2023. In Fall 2024 there was an increase to 98 majors. Most of the Department's recruitment efforts focus on advertising options for mathematics and statistics degrees in calculus courses (Math 161, 211, 241, and 261) and in statistics courses, in particular in Math 165. During the pandemic, these efforts suffered and we have only recently started up again with an organized effort to visit these courses and tell students about our degree programs. Few students enter Sonoma State intending to major in mathematics or statistics, so most of our majors discover their love for the field in one of our lower-division courses. Many of the students who *do* enter SSU with a math major are planning to become

high school math teachers. Unfortunately, since the pandemic, the number of future high school math teachers has decreased significantly, which has had a significant impact on enrollments in math courses in the secondary teaching concentration of the Mathematics B.A.

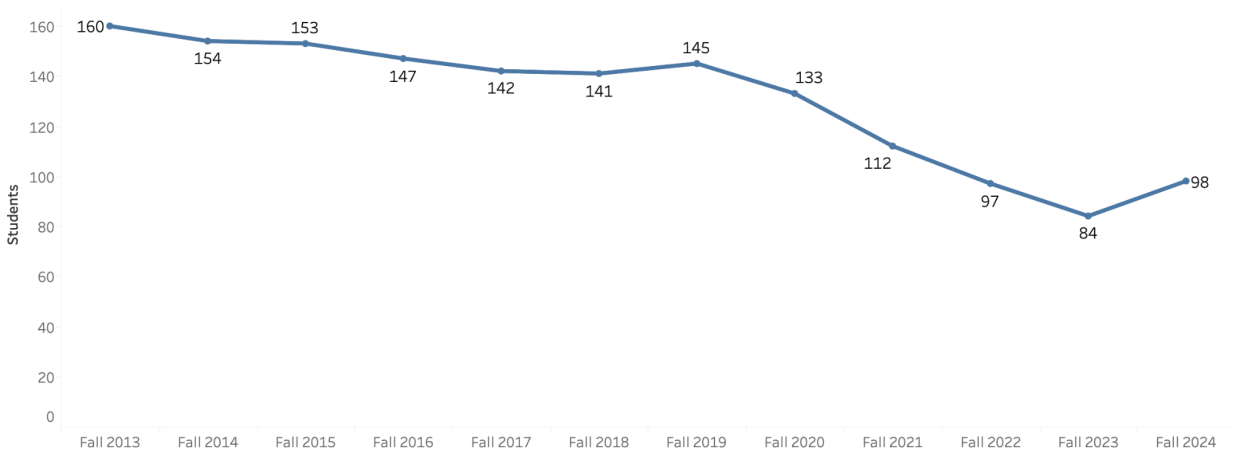
While the number of mathematics majors has decreased over recent years, the number of degrees awarded has been higher. This might be due to the fact that students in the Bi-Disciplinary Mathematics BA program declare this major very late, sometimes only when they are ready to apply for graduation or when they have room in their schedule to pick up a second major late in their career.

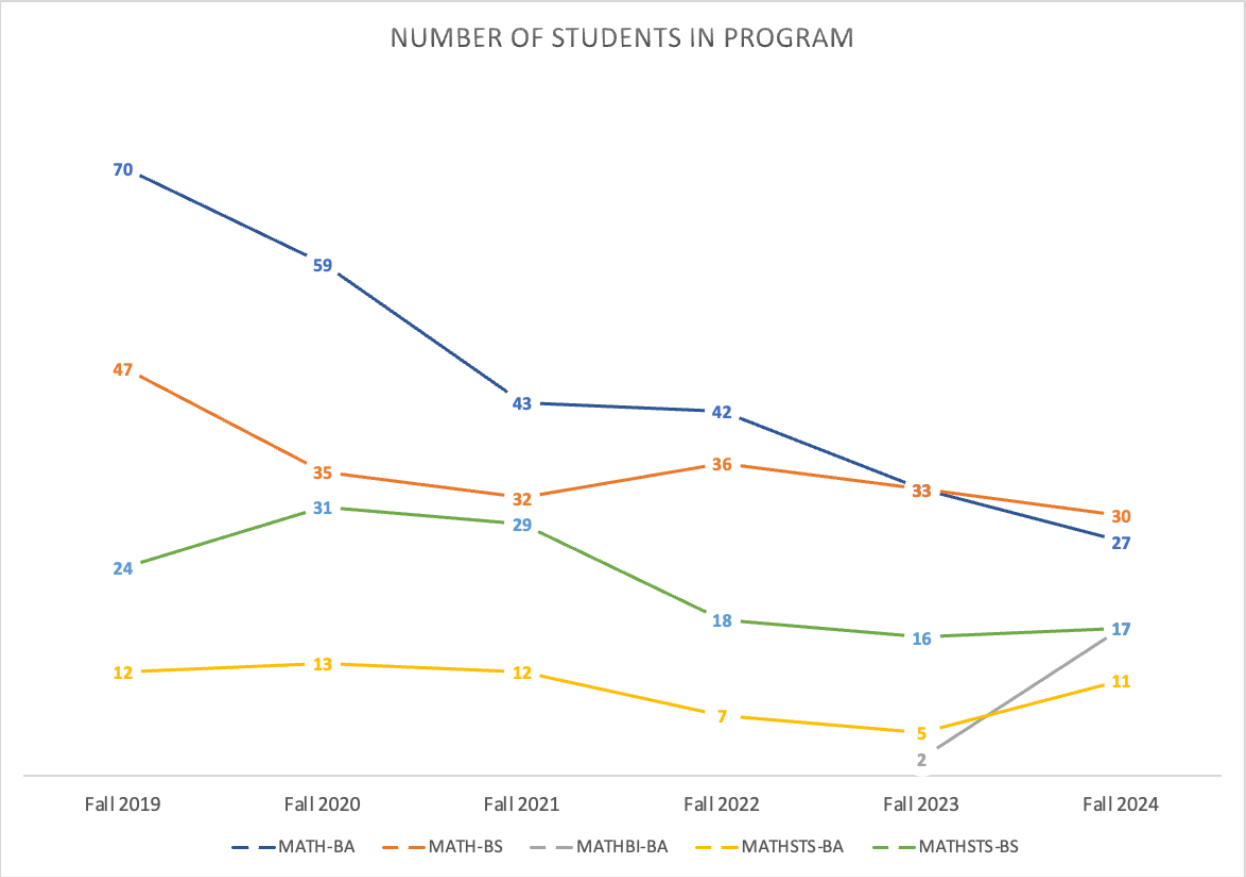
All data in this section needs to be contextualized within Sonoma State University's dramatic enrollment decrease, illustrated in this graph of undergraduate headcount since just prior to the pandemic. While we are hopeful that enrollment has reached its nadir and will begin to recover, recent news coverage of program cancellations may mean at least one more year of decline.



Overall Enrollment and Degrees Awarded

Year	Department #majors (Fall)	First Gen	URM	Female	Department Degrees awarded	SSU Bachelor Degrees Awarded	% SSU grads with Department major
14–15	154	20.1%	31.8%	44.8%	31	2035	1.52%
15–16	153	22.2%	32.7%	46.4%	35	2084	1.68%
16–17	147	23.1%	34.7%	42.9%	45	2319	1.94%
17–18	142	21.8%	33.8%	43.7%	43	2343	1.84%
18–19	141	16.3%	32.6%	45.4%	42	2499	1.68%
19–20	145	20.0%	37.2%	45.5%	53	2318	2.29%
20–21	133	25.6%	45.9%	48.9%	46	2294	2.01%
21–22	112	23.2%	43.8%	47.3%	32	2116	1.51%
22–23	97	22.7%	49.5%	53.6%	37	1961	1.89%
23–24	84	22.6%	41.7%	39.3%	28	1772	1.58%
24–25	98	21.4%	43.9%	32.7%	–	–	





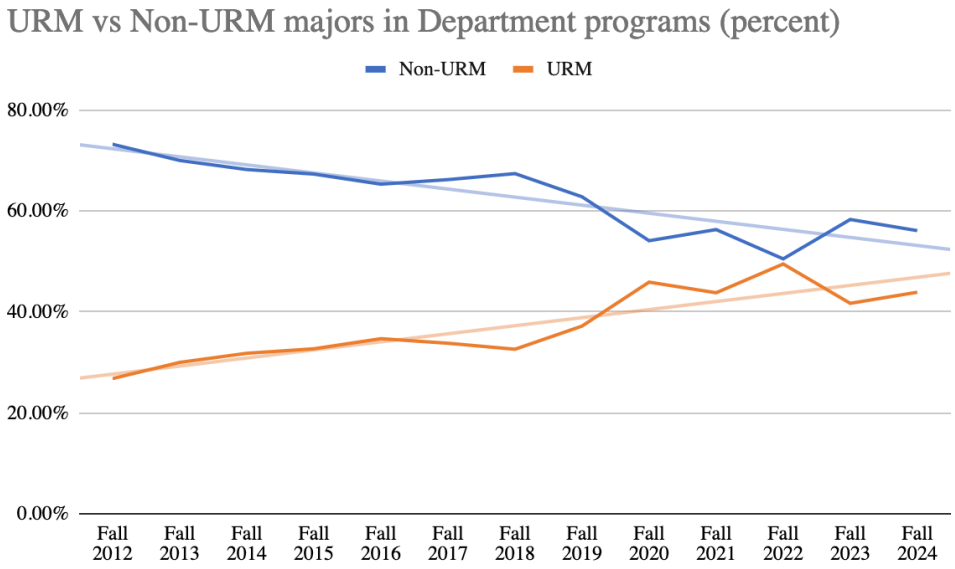
The previous diagram shows the number of students in the different degree programs. The Math-BA label includes concentrations in pure and secondary teaching mathematics. From Fall 2019 until Fall 2022 this category also includes a concentration in bi-disciplinary mathematics, which became its own degree program in Fall 2023 (some continuing students are completing the preexisting concentration rather than switching to the new standalone major). So the drop in Math-BA in Fall 2023 and 2024 is mostly due to this change.

The Math-BS category includes degrees in applied mathematics, which has been pretty stable since an initial drop from 2019 to 2020. The two degree programs in statistics have seen a drop in numbers post-pandemic but are hopefully on a way to recovery with our renewed recruitment efforts in lower division statistics GE courses.

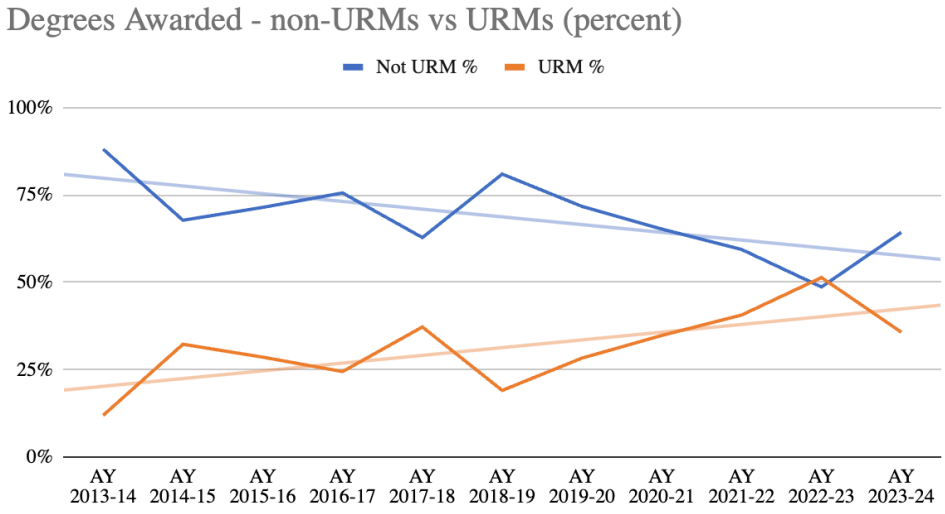
Broadening the Mathematical Sciences Community

The graphs below illustrate two notable trends in student enrollment in and completion of Department programs. The percentage of underrepresented minority (URM) students among Department majors has increased to the 40–49% range. This is in line with the increased URM population at SSU (in Fall 2024, SSU's URM student enrollment was 44.5% of total enrollment). There has been significant change in the number of female mathematics majors in recent years. While the proportion of female students was consistently in the mid to high 40% range, in the last two years this number has decreased—to 32.7% in Fall 2024. One explanation for this

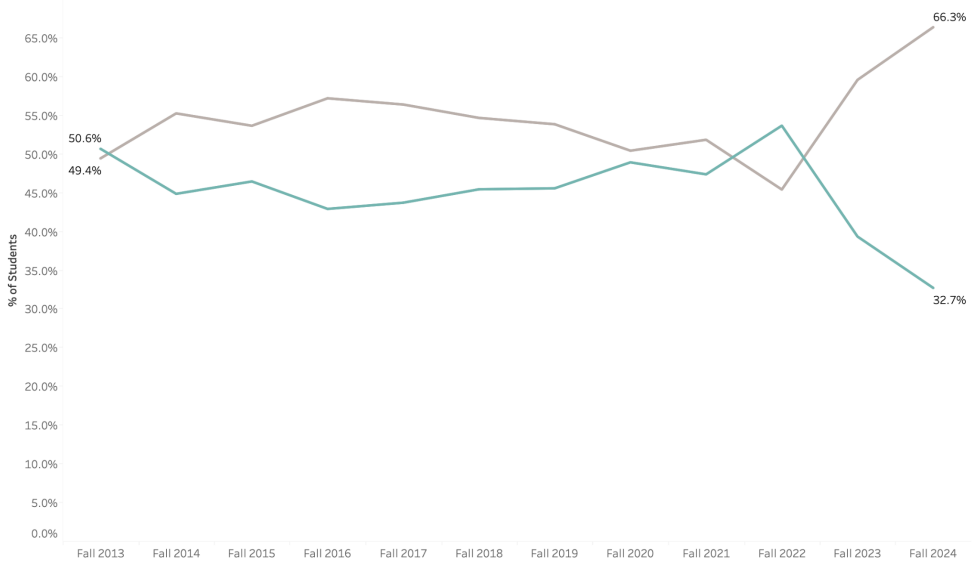
change might be the shift away from secondary teaching in addition to an increase in Bi-Disciplinary Mathematics majors (mostly double majors), who are mostly drawn from electrical engineering and computer science majors—majors that are nationally the most male-dominated according to IPEDS data.



Enrolled majors in Department Programs, Fall Semesters



Degrees awarded in Department programs



Gender trend among declared majors in the Department (enrolled students; green: female, brown: male)

The Department is connecting students with support organizations like MESA (Math, Engineering, Science Achievement) and LSAMP. In 2024, 10% of MESA students were Mathematics and statistics majors. In the last 5 years, three of the SSU Trustee awardees were mathematics and statistics majors: Therese Azevedo (2020), Serina Cabrera (2022), and Bryce Iversen (2024).

Course-level student success

The Department's highest-impact DFW courses (as measured by number of students leaving with a grade of D, F, or W) are Math 165 Elementary Statistics (26%, five-year average DFW rate, 2019–24) and Math 161 Calculus 1 (23%). The Math 161 Calculus 1 DFW rate is the fourth lowest in the CSU system; yet students who continue to Math 211 Calculus 2 succeed at a very high rate (see table in the GE Assessment section above). All campuses with a lower Calculus 1 DFW rate (Pomona, SLO, East Bay, and Long Beach) also have a campus-based placement system and require a significant number of their students to take Algebra and/or Precalculus before being allowed to take Calculus 1. This leads to lower overall pass-through rates for the full course sequence (given the compounding effect of multiple points of possible failure), requiring students to spend extra time and money before meeting the calculus requirement compared to students at SSU.

The DFW rate for Math 165 at SSU is in the middle of the comparison group (tied for 14). There has been an increase by about 5 percentage points comparing pre-and post pandemic DFW rates. The Department will investigate the cause of this change and ways to reverse it.

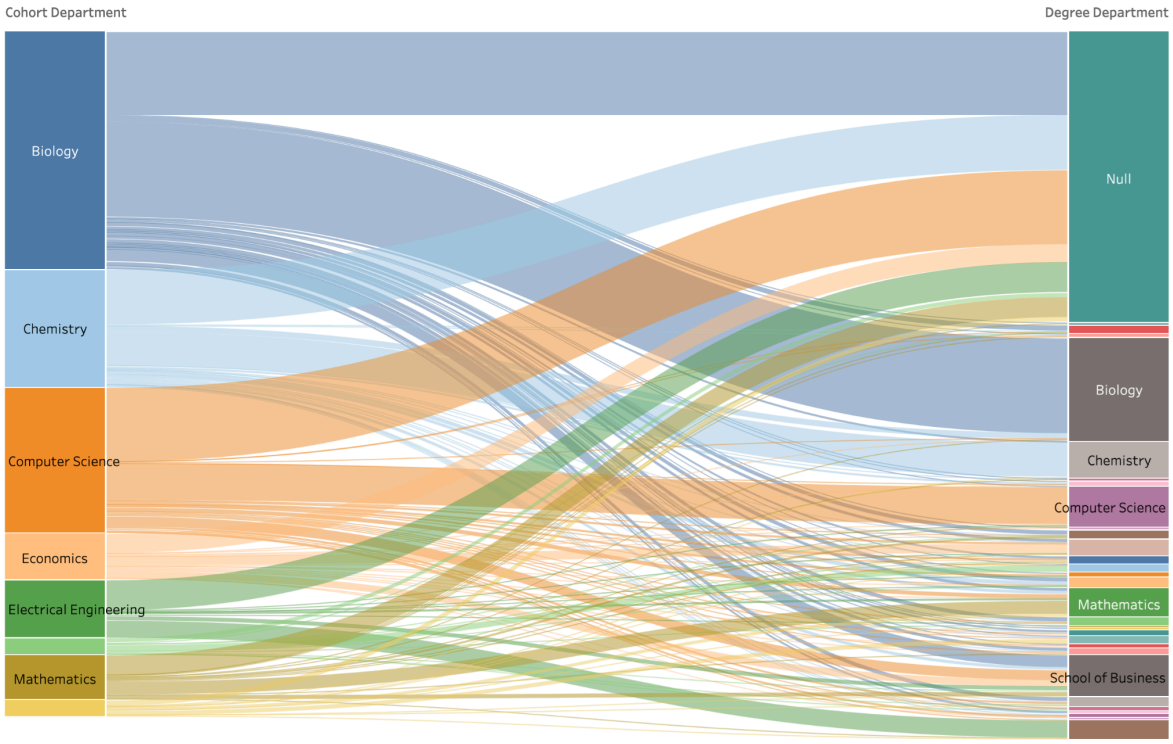
Campus	161 DFW rate (%)	165 DFW rate (%)
East Bay	14	21
Long Beach	18	12
San Luis Obispo	22	10
Sonoma	23	26
Pomona	23	26
San Diego	24	10
San Francisco	24	21
Sacramento State	27	22
Humboldt	27	31
Chico	28	25
San Bernardino	29	18
Los Angeles	29	30
Channel Islands	30	23
Fresno	30	26
Monterey Bay	30	30
Stanislaus	31	22
Dominguez Hills	31	26
Fullerton	34	17
Maritime	34	20
San Jose	34	27
San Marcos	35	19
Bakersfield	36	30
Northridge	42	26
Average	28.5	22.5

Persistence and Recruitment in the Department

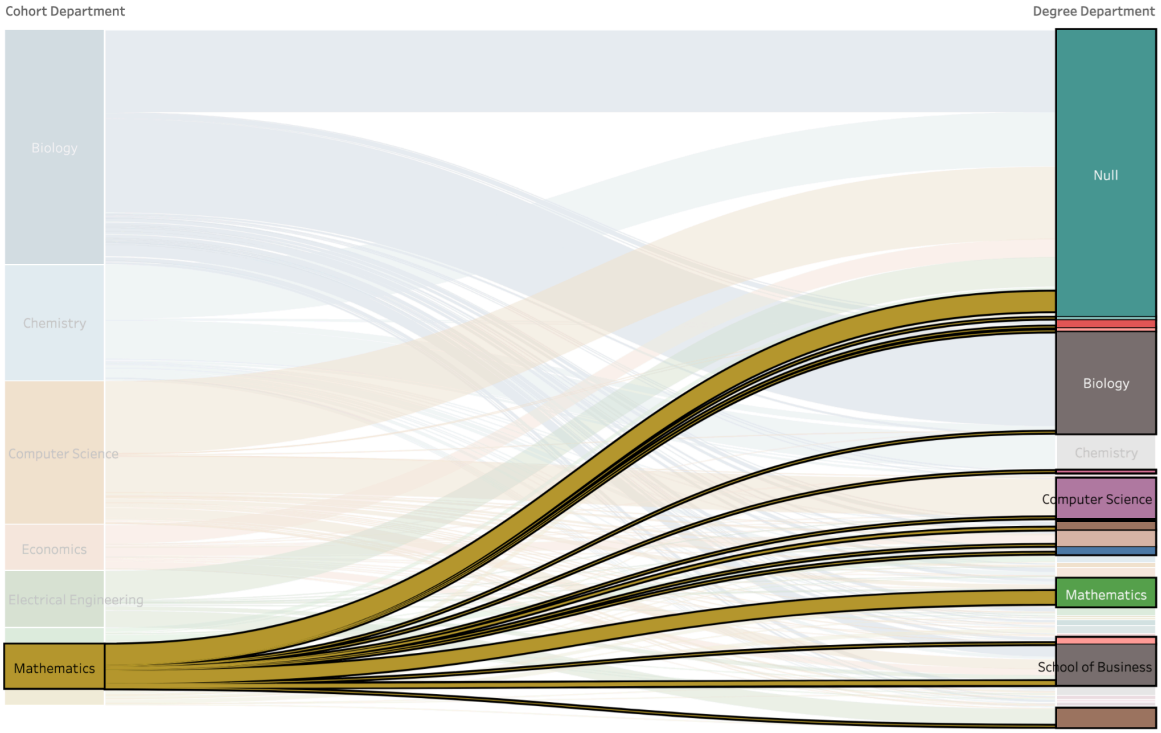
One focus for our student success analysis is an examination of the persistence of students who enter with an intention to major in one of our programs, and the source of students who eventually graduate from one of our programs. SSU's Institutional Effectiveness office created a tool to generate Sankey diagrams to examine these questions. The diagrams below represent the 2014–2018 entering cohorts of First-Time Freshmen (FTFs), and 2014–2020 for transfers. The years were chosen to reflect at least 6/4 years since entry, with most of their experience at SSU being since the previous program review. We compare our students' persistence in the major with other STEM departments and consider sources of our graduates with other or unspecified intentions when they entered.

The first four diagrams show all students who entered with a declared STEM major either as FTFs or transfers (with declared Math/Stats entering students highlighted in the second diagram). "Null" in the "Degree Department" column indicates students who did not complete a degree at Sonoma State. For FTFs we see very similar patterns of persistence in the Department across all STEM departments, with no department maintaining a majority of their entering students through to graduation. For transfers, the mathematics and statistics department is in the upper half of departments with persistence rates of 69% and above. The other 4 departments' rates are between 50% and 60%. The other Persistence to degree rates by department are summarized here:

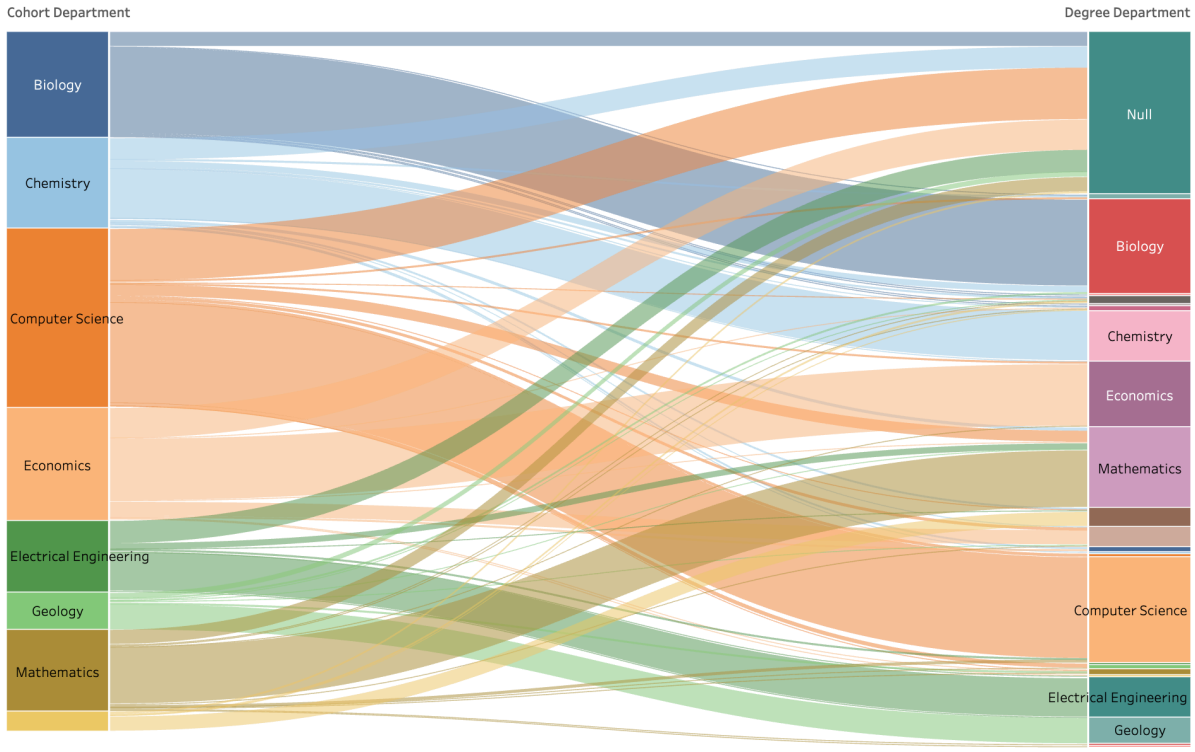
Department	**Persistence in Department to Graduation (FTF)**	**Persistence in Department to Graduation (transfers)**
Mathematics and Statistics	29% (29/100)	70% (66/94)
Biology	40% (215/536)	82% (100/122)
Chemistry	29% (77/265)	54% (57/105)
Computer Science	25% (83/328)	57% (117/207)
Economics	20% (20/102)	55% (72/130)
Electrical Engineering	30% (39/130)	54% (45/83)
Geology	36% (13/36)	69% (29/42)
Physics and Astronomy	25% (9/35)	77% (17/22)



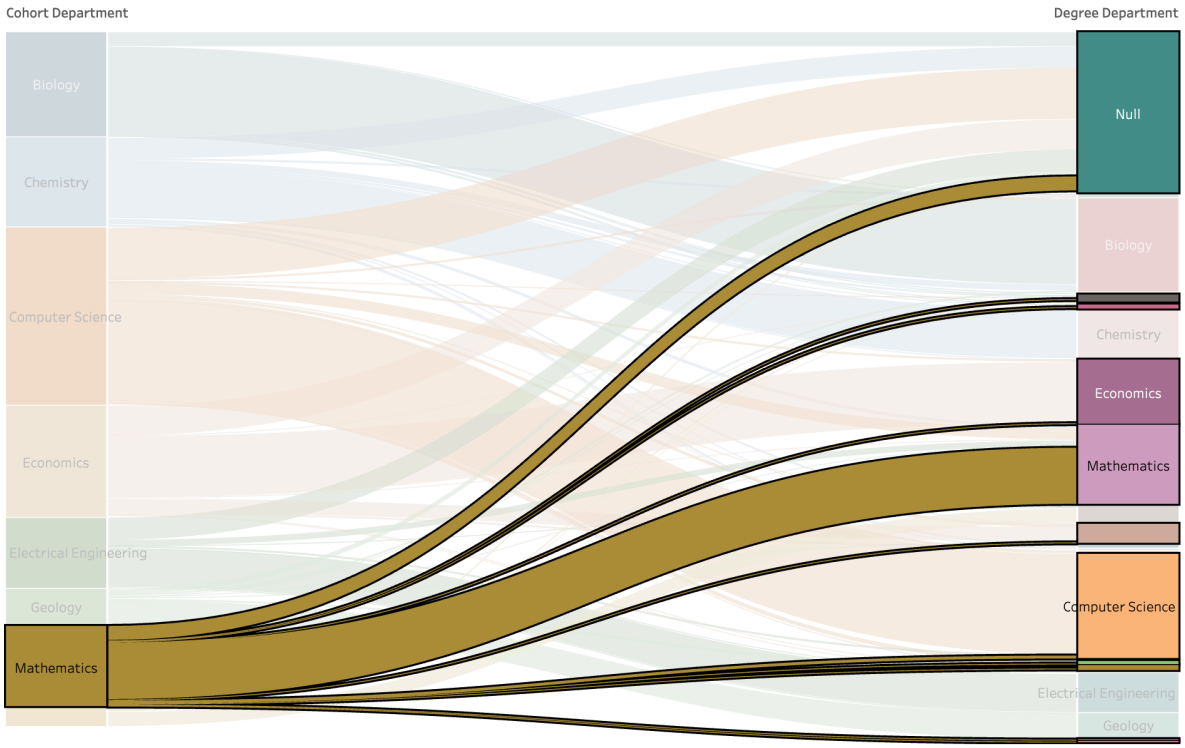
All students who entered as FTF (Fall 2014–18) with declared STEM majors (*n* = 1662), with department of graduation. “Null” = not (yet) graduated



Same diagram as previous, with Mathematics and Statistics Department highlighted (*n* = 100)

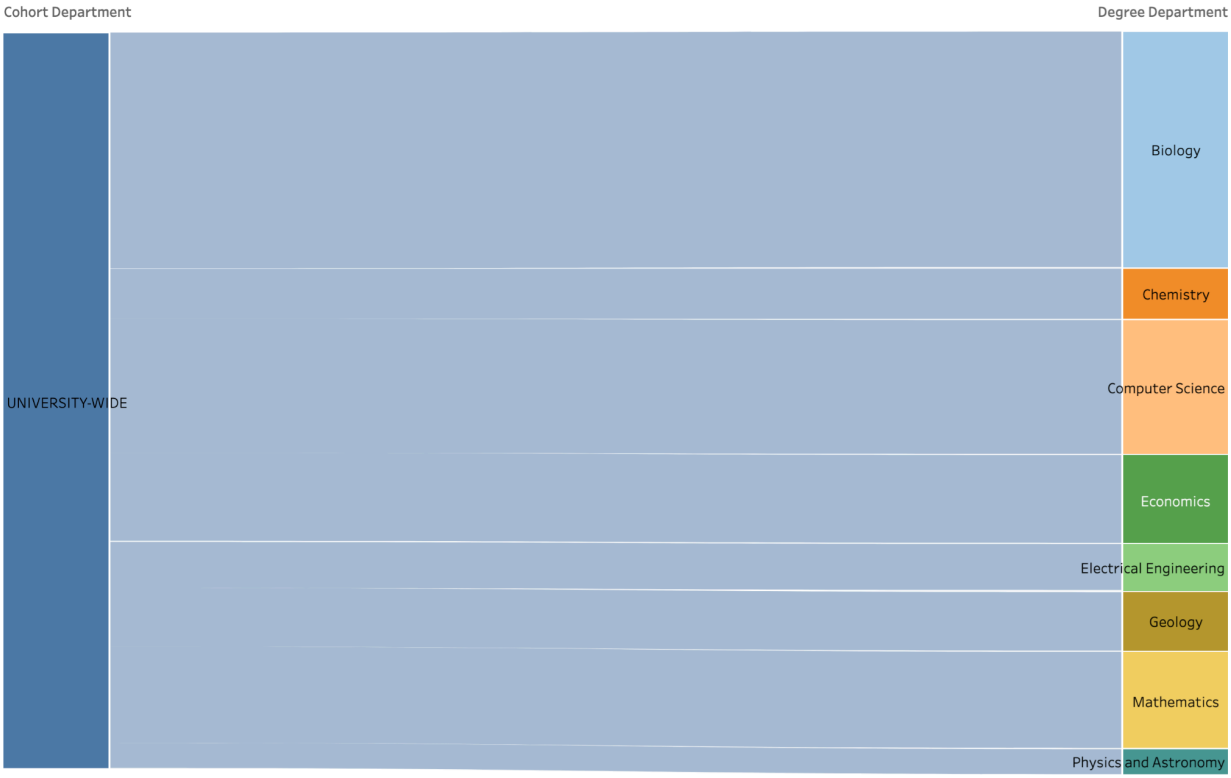


All students who entered as transfers (Fall 2014–20) with declared STEM majors (*n* = 805), with department of graduation. “Null” = not (yet) graduated



Same as previous graph, with the Department highlighted

Since few students enter college intending to major in mathematics or statistics, the Department has always had a focus on helping students find their interest in our fields through our support and GE courses. The next diagram indicates our success at recruiting undeclared students to our majors, with our success at graduating undeclared-at-entry students surpassed only by much larger programs (Biology and Computer Science).



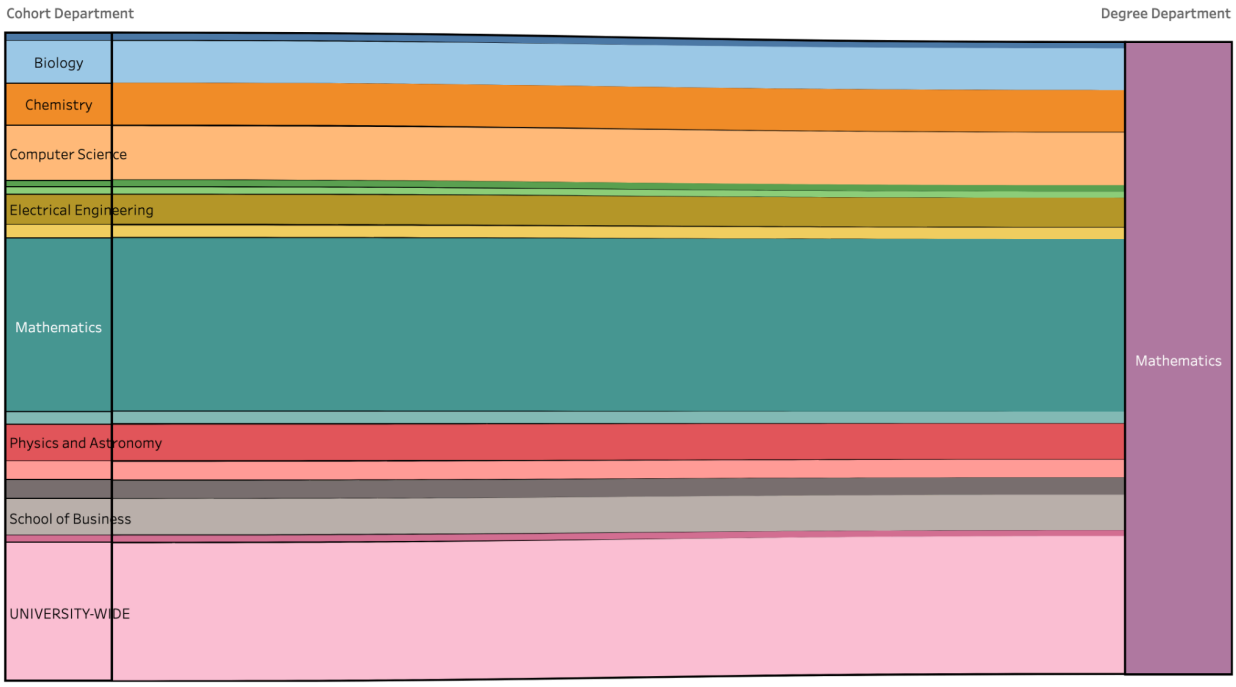
Fall 2014–18 entering FTF cohorts: Undeclared at entry, graduated in STEM (*n* = 175, math/stats graduates = 23)

The following table gives the graduating department of all students who entered with a declared major in the Department. This gives a bit more detail to the persistence data in the table at the beginning of the section.

Entering Department	**Degree Department**	**Student Count (transfers, 2014–20)**	**Student Count (FTF, 2024–18)**
Mathematics	School of Business	1	9
Mathematics	Psychology	1	1
Mathematics	Philosophy	1	0
Mathematics	Mathematics	66	29
Mathematics	Kinesiology	1	0
Mathematics	History	1	0

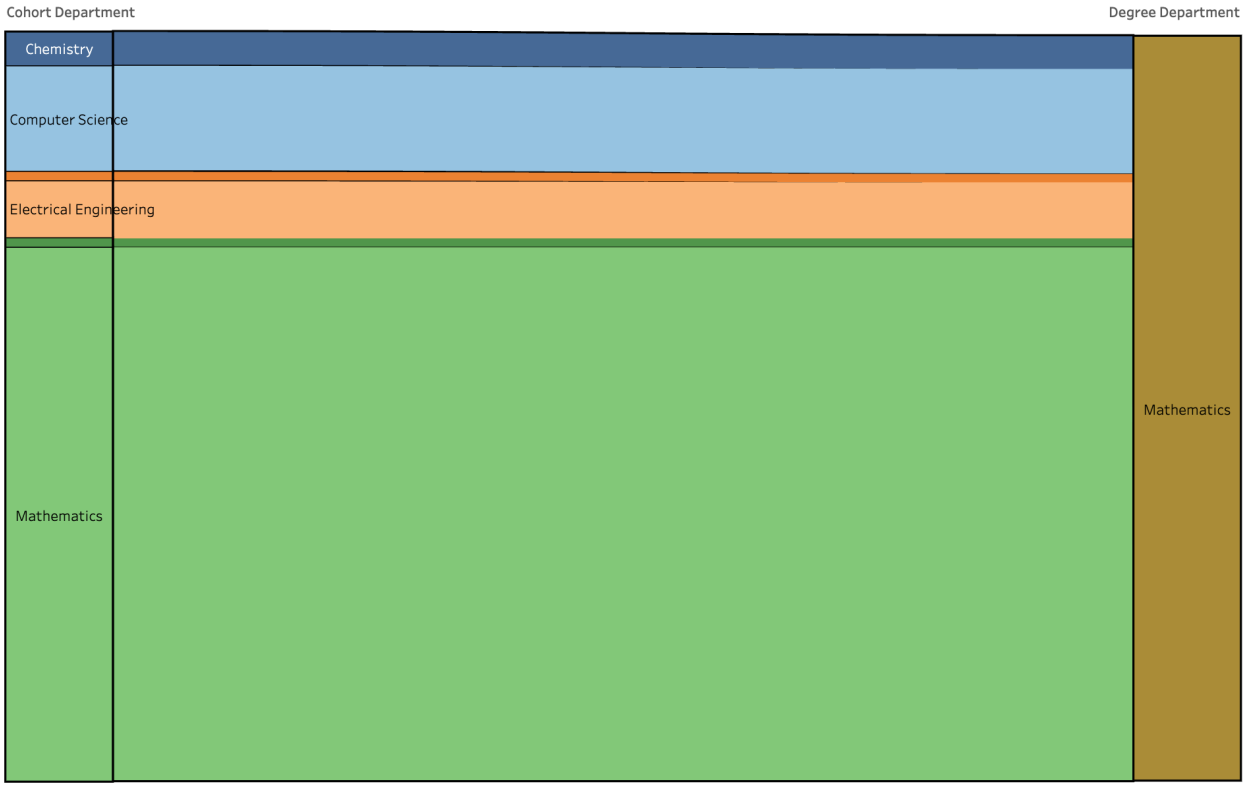
Entering Department	Degree Department	Student Count (transfers, 2014–20)	Student Count (FTF, 2024–18)
Mathematics	Geog, Environ, Planning	1	3
Mathematics	Economics	1	2
Mathematics	Computer Science	3	1
Mathematics	Art	1	2
Mathematics	Not (yet) graduated	17	44
Total		94	91

When we examine the original academic majors of all of our graduates who spent their entire college career at Sonoma State, we see that our majors come from many fields ("University-wide" means no declared major at entry).



Fall 2014–18 entering FTF cohorts: Original majors of all students who graduated in the Department (*n* = 106)

Finally, even among transfer students, a substantial portion of our graduates enter SSU with a different intended major:



Fall 2014–20 entering transfer cohorts: Original majors of all students who graduated in the Department (*n* = 92)

It is clear that, for the Department to thrive going forward, recruitment to the major will continue to be an important focus, along with support for students who enter with an intended major in the Department. The Department has a conviction that all students are capable of understanding mathematics and statistics at a high level. Thus, we believe that opening students' minds to possibilities in the Department and to a bigger vision for the disciplines will continue to help students find their way to a home in our Department.

Percentage of SSU Graduates with a Mathematics or Statistics Major

In the Overall Enrollment table above, we included the percentage of all SSU Bachelor recipients who earn a degree through our Department. The graph below, taken from a November 2024 article in the Notices of the American Mathematical Society (Scott A. Wolpert, The Math Major—What Size?: Accessing Data on Your Program), demonstrates that our consistent 1.5–2.0% rate puts the Department in the upper third of mathematical sciences nationwide. One caveat is that the graph reflects students' degree that appears *first* in their record, so that some double majors aren't captured in the graph (whereas they are reflected in our Department data).

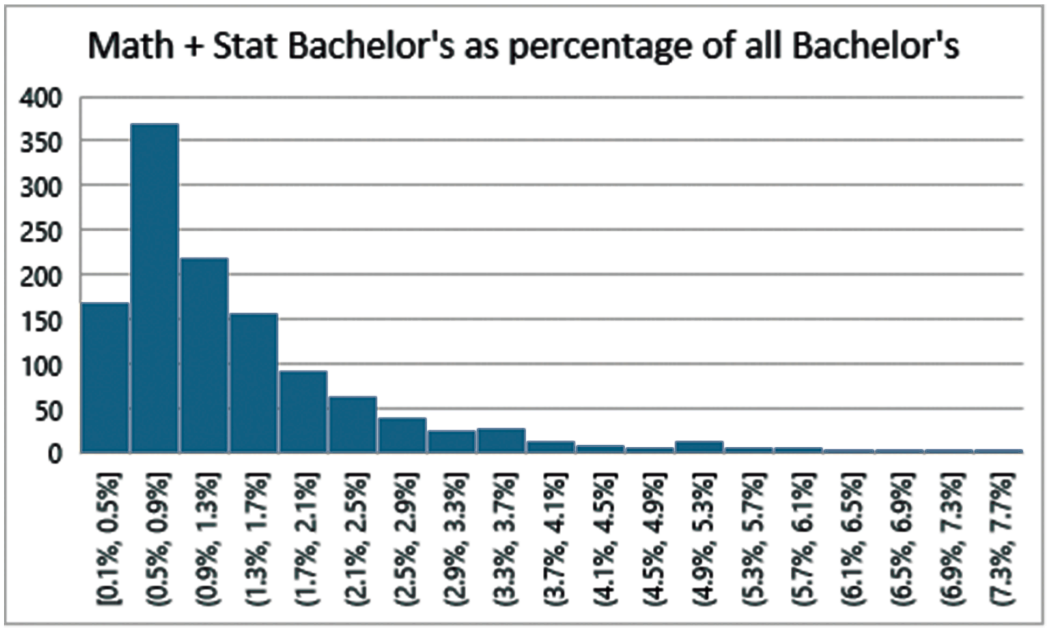


Figure 1. The 2019–2021 average national distribution of math + stat first major bachelor's degrees as a percentage of all first major bachelor's.

Activities and Career Paths of Department Graduates

The SSU Math & Stats Alumni Survey provides insights into the activities and career paths of graduates. Key trends include:

1. **Employment Sectors**:
    - Many alumni have entered industries such as education, technology, finance, and data analytics. Teaching positions in high schools and colleges are a common path for those with an interest in education.
2. **Graduate Studies**:
    - A significant proportion of alumni pursue further education, enrolling in graduate programs in mathematics, statistics, data science, or related fields.
3. **Skills Utilization**:
    - Alumni frequently report that their statistical and mathematical training is directly applicable to their current roles, particularly in problem-solving, analytical thinking, and data analysis.
4. **Job Titles and Roles**:
    - Graduates hold diverse roles such as data analysts, statisticians, educators, and software developers, reflecting the versatility of a mathematics or statistics degree.
5. **Geographic Trends**:

    - Alumni often remain within California but also find opportunities nationally and internationally, reflecting the Department's broad influence.
6. **Feedback on Preparation**:
    - Graduates often cite the practical and theoretical foundation provided by their courses as instrumental in their career success. Courses in statistics, applied mathematics, and capstone projects are particularly appreciated.

Reflection and Plan of Action

Reflection

On reflection, the Department has many points of pride in its work since the 2016 program review:

The Department has always prided itself in fostering a cohesive, student-focused culture, and maintaining this tradition is one of our most important goals. Since the last program review, the Department has expanded on what it means to be welcoming and inclusive with intentional efforts to broaden participation in Mathematics and Statistics (and STEM). This included the initiative to reimagine and then implement new pathways through math GE and STEM support courses, which has increased the percentage of students taking calculus courses at SSU. We have engaged in extensive Department-level work to improve students' experience of belonging in the disciplines through the TIPS program. In both areas, improving the GE math trajectory for all SSU students and increasing experiences of belonging in STEM, our faculty have taken on leadership roles at the SSU STEM, University, CSU system, and national STEM education levels. By engaging in this work, the Department has had a profound impact on STEM teaching at SSU and beyond.

In addition to better serving all students at SSU in their mathematics experiences, the Department has worked in improving the experiences of students in our major programs. In the review time interval, we successfully hired two faculty members with expertise in applied mathematics and statistics, which is bolstering our statistics programs and enabling us to soon offer programs in data science. Our graduates have experienced a high level of success in job placement and acceptance into graduate school. We have increased the opportunities for research experiences and many students regularly participate in the annual SSU Undergraduate Research Symposium.

All of these efforts are ongoing and will continue to be Department foci for the next five years.

Plan of Action

Throughout the report, these areas of future focus for Department work have emerged:

Curriculum/Program

- Leading the University's data science focus
- Evaluating student mathematical/statistical software experiences to ensure they align with learning objectives and with post-graduation expectations
- Addressing declining enrollment in pure math and teaching concentrations through better recruitment and possible program/pedagogy changes
- Supporting students in getting internships; add future-oriented work in capstone courses (e.g. resumé assignments)
- Make the math colloquium a required course in all programs

Assessment

- Clarifying the alignment of student projects in capstone courses to program learning objectives, and including these projects in PLO assessment in the future
- Aligning alumni and graduating senior surveys with program learning outcomes

Student success/retention/belonging

- Deepening of efforts to understand and reverse the marginalizing effects of traditional understandings of and teaching of mathematics and statistics
- Investing in reversing the rise in DFW rates in the Department's most populous course, Elementary Statistics (Math 165)
- Develop and implement a comprehensive recruitment plan.

Acknowledgements

The Department would like to thank the Office of Institutional Effectiveness at Sonoma State University for the creation of custom data retrieval and visualization tools to help examine issues that the Department identified as meaningful.

Appendices

Statement on Active Learning

(also on the Department website)

The Department of Mathematics and Statistics at Sonoma State is committed to active learning in all its classes. Active learning engages students in the process of learning during class—through writing, talking, problem-solving, and reflecting—in contrast to passively "receiving" knowledge from an expert. It emphasizes higher-order thinking and often involves group work. The research evidence is overwhelming that “active learning increases student performance in science, engineering, and mathematics.” From a risk perspective, “on average, students in traditional lecture courses are 1.5 times more likely to fail than students in courses with active learning”. (Freeman et al., Proceedings of the National Academy of Sciences, 2014).

Active learning pedagogies provide greater opportunities for success in learning by students from all backgrounds. Particularly students historically shut out of mathematically-based majors and careers (including Native American, Latin*, African-American students, and women). This conclusion is endorsed by a 2016 joint statement of all major mathematics, statistics, and mathematics education professional organizations in the United States, which calls the mathematical sciences community to a community-wide effort to transform teaching at the postsecondary level.

The Freeman study explains the significance of the difference made by active learning pedagogy:

> “If the experiments analyzed here had been conducted as randomized controlled trials of medical interventions, they may have been stopped for benefit—meaning that enrolling patients in the control condition might be discontinued because the treatment being tested was clearly more beneficial.”

The Department recognizes that changing teaching practice is difficult work, and is committed to supporting new and continuing faculty in this change. Such support will include access to books and materials, professional development opportunities, and co-teaching opportunities.

Active learning methods span a wide range of pedagogical approaches, all designed for students to engage in mathematics in and out of the classroom; and for students to try difficult things, receive feedback, and improve their practice. Examples include:

- Think-Pair-Share (TPS), which can be implemented many times in every class. The instructor poses a brief task (conceptual question, calculation, explanation), asks students to try to complete the task independently (perhaps writing down their solution for themselves), then discuss it with a partner, then share some solutions with nearby groups or with the class. This classic technique was recently shown to have high efficacy in a randomized experiment; see Bernstein et al.

- Collaborative learning in which learners engage in a common task where each individual depends on and is accountable. This is often done in small groups with a shared end product. For a fuller description, see the Department resources on Small Group Instruction.
- One-minute paper or exit ticket: Strategically-placed brief reflective writing exercises, which help students reflect on significant concepts and instructors gain quick insight into their students' current understanding.
- Paired board work: In pairs, students solve problems or explore patterns on the board. One student is assigned to scribe; the other is a quality controller.

Many more pedagogical tools and more detail are in the Mathematical Association of America's Instructional Practices Guide, including more intensive active learning pedagogies such as Flipped classrooms and Inquiry-based learning.

Supporting HSI STEM Departments to Achieve Transformative Inclusion in Undergraduate STEM Education – Annual Evaluation Report – Year 4

Prepared by Andrew Grillo-Hill, Ph.D.
WestEd
April 2024

INTRODUCTION

Supporting HSI STEM Departments to Achieve Transformative Inclusion in Undergraduate STEM Education program (referred to as Program) at Sonoma State University (SSU) aims to increase the participation and success of Latinx students in STEM by transforming STEM department cultures to become truly "Hispanic-Serving." The Program plans to achieve this through piloting and testing a two-year departmental pathway that will address persistent marginalization and underrepresentation of Latinx students in STEM. The Pathway will comprise: (1) workshops and exploration regarding factors contributing to Latinx underrepresentation in STEM, including stereotype threat and implicit bias; (2) introduction to culturally responsive pedagogies; (3) collaborative implementation of these practices in gateway STEM courses via Lesson Study; (4) review of institutional barriers and STEM students' connections to campus resources; and (5) implementation of High Impact Practices to increase student sense of belonging in STEM fields.

To help evaluate the Program SSU hired WestEd as external evaluators. WestEd will conduct an independent, mixed-methods external evaluation that provides Program staff with formative feedback as well as document the extent to which the project meets its intended goals and objectives. The major foci of the external evaluation are to ensure that implementation processes are working efficiently and effectively, and to provide summative data about the impact of the Program, and its various elements, on participating students. This evaluation report

summarizes the evaluation activities during Year 4 of the project from May 1, 2023, through April 30, 2024.

PROJECT MEETINGS AND PROGRESS

Team meetings, established during the first three years of the project, continued during the fourth year. These meetings include regularly scheduled meetings by the project leadership (PI and Co-PIs), research team, PD team, and with the external evaluator (monthly with the PI). The advisory panel has also met semi-annually with meetings on April 25, 2023, and November 7, 2023. The next advisory panel meeting is scheduled for May 7, 2024.

The fourth year of the project saw the second cohort of faculty start the second year of The Pathway; participating in a summer workshop, fall/spring task force meetings, and fall/spring Lesson Study. Cohort 2 of the Pathway includes faculty five (5) different STEM departments; Biology, Chemistry, Computer Science, Geology, and Physics.

EVALUATION DATA COLLECTION

During Year 4 of the project, evaluation data was collected through monthly meetings with the PI, preparation for administration of the Culturally Engaging Campus Environments (CECE) survey of students and faculty in Spring 2024, observations of select workshops, and observations of the advisory panel meetings. Student and Faculty responses to the CECE survey are currently being collected. Analysis of these responses and comparisons to the presurveys, collected in 2020, 2021, and 2022, will occur later in Year 5 of the project.

EVALUATION FINDINGS

From the evaluation data collected above, the project is on track to complete Year 4 task and be ready for Year 5. WestEd evaluators monitored project progress through meetings with the PI, Co-PIs and observing advisory panel meetings. Major project milestones have been met and challenges have been met to the best of project staff's abilities.

EVALUATION RECOMMENDATIONS

As the project enters the fifth and final year of the program evaluators make the following recommendations:

- Continue dissemination of early research findings at relevant conferences and the preparation of manuscripts prior to the completion of the grant activities.
- Continue planning for future dissemination of the Pathway model and consider if any maintenance activities may be necessary. This could include considering the following questions:
    - How can other universities learn about the Pathway and participate or adapt it to their context?
    - Is there an introductory experience that can be used for other university departments to determine if they are ready to participate in the full Pathway.
    - How will participating departments at SSU maintain changes resulting from the Pathway?

SUMMARY

In summary, the project has successfully completed Year 4 with cohort two completing their second and final year of the Pathway. Year 4 activities including the Pathway for cohort 2, research data collection and analysis, and continued dissemination of the Pathway. The program is well positioned for Year 5 of the project which will see the continued packaging of the Pathway for more dissemination. The Program has maintained good working relationships and structures to enable staff and collaborators to complete the project on schedule.

Faculty CVs

Faculty CVs are collected in this Google folder.

Curriculum maps(s) & Syllabi

Advising Plans and Curriculum Flow Charts are at the math and stats department website.

Syllabi for the 2024/25 academic year are in this Google folder.

Other Resources

Math and Stats Department Website

Newsletters 2015–2025